Essays on School Nutrition and Health Programs

Divya Deepthi

Submitted to the University of Warwick for the degree of

Doctor of Philosophy

Department of Economics

University of Warwick

September 2017

Table of Contents:

Chapter 3: The Impact of a School Nutrition program in India on Primary School Completion

Section B: The impact of a Government School Health Program in India on pupils' educational and health outcomes

List of Figures

Figures in Section A:

Chapter 1

Chapter 2

Chapter 3

Figures in Section B:

List of Tables

Tables in Section A:

Chapter Two

Chapter Three:

Tables in Section B:

List of Appendices

Section A:

Chapter 2:

Chapter 3:

Declaration

I declare that the thesis is my own work and has not been submitted for a degree at another university. The contents of this thesis are based on my own research in accordance with the regulations of the University of Warwick. The work in this thesis is original, unless where indicated by references.

Divya Deepthi

September 2017

Acknowledgements

I would like to start by saying that I am sincerely grateful to my supervisors, Professor Wiji Arulampalam and Professor Victor Lavy for their patient guidance, support and advice. Their feedback has been nothing short of invaluable. They have tirelessly ensured that I was progressing on the right track and have helped me persevere in every step of the way. I am thankful for this opportunity to work and learn from them. They have been so kind and helpful throughout. I am truly indebted to them as this thesis would not be possible without them.

I would like to take this opportunity to thank my parents, Mr Anantha Janardhana and Mrs Saroja Janardhana for all their help and advice. Their wisdom, unwavering support and encouragement have been truly exceptional. They have been my primary source of inspiration. This thesis would not be complete without them.

I would also like to express my gratitude to all my friends and colleagues for all their help, advice, and support.

I gratefully acknowledge funding from the Economic and Social Research Council (ESRC) Doctoral Training Centre. The Overseas Fieldwork Funding grant has enabled me to collect administrative data from India and subsequently digitise the same. Further, the RTSG grants have also assisted me to attend relevant summer school courses and have assisted me in obtaining household survey datasets made available by the Government of India. I also gratefully acknowledge funding from the Department of Economics at the University of Warwick.

Lastly, I would also like to thank Dr N.K. Sahu, Chief Economic advisor from the Ministry of Rural Development and Mr Gaya Prasad, Director of the Ministry of Human Resource Development, Government of India for kindly providing me with the required information and data needed to complete this thesis. I would also like to thank Mr Yellappa for granting me access to collect administrative data from Public schools in Karnataka. I am also thankful to the school headmasters and teachers who cooperated and assisted me in collecting the data needed for this thesis.

Abstract

This thesis investigates the impact of School Nutrition and Health programs implemented by the Government in Public primary schools in India.

Section A focuses on evaluating the National Program of Nutritional support to Primary Education launched in 1995. Under this scheme, children enrolled in government primary schools received 3 kilograms of food grains per month, free of cost, conditional on enrolment and a minimum attendance requirement. In chapter 1, we provide a detailed survey of the related literature, highlighting the multi-dimensional impacts of these programs on educational and health outcomes. In Chapter 2, we evaluate the impact of the School feeding program (SFP) in India on primary school starting age and enrolment using the National sample survey. We adopt two methodological frameworks to estimate the program impact, namely, a difference-in-differences (DID) technique and duration analysis. The findings indicate that the program was effective in increasing enrolment and encouraging children to start school at the stipulated entry age. In chapter 3, we study the impact of the SFP in India on primary school completion using the District Level Household survey. Using the DID methodology, we find that the program had a positive effect on primary school completion, with differential effects by gender and years of program exposure. Additionally, we identify whether the program generated positive educational externalities between siblings in the family.

Section B of this thesis evaluates a complementary policy, The School Health Program implemented in Government primary schools in Karnataka, India. The program provided free health services to students in public schools, consisting of- micronutrient supplements, deworming treatment and regular health screenings by Doctors at the school premises. We investigate whether this program was effective in improving pupils' educational and health status. Using administrative data on student's academic and health records collected from public schools, we find that the program led to an increase in school participation measures and academic performance, with heterogeneous effects across subjects and performance distribution. The program impacts on anthropometric indicators are positive, but statistically insignificant for both boys and girls.

We conclude that School Nutrition and Health programs are extremely beneficial in a developing country context to improve children's educational and health status, by lowering schooling costs and by providing parents with incentives to send their children to school. These programs have the potential to improve future welfare and quality of life, through increased educational attainment and improved health and nutrition.

Abbreviations

AIES: All India Education Survey

ARI: Acute respiratory infections

ASER: Annual Status of Education Report

CAG: Comptroller and Auditor General of India

DID: Difference-in-Differences

DISE: District Information System for Education

DLHS: District Level Household survey

FCI: Food Corporation of India

FE: Fixed effects

NER: Net Enrolment Rate

NFHS: National Family Health survey

NSS: National sample survey

OBC: Other Backward Class

RE: Random effects

SC: Scheduled Caste

SFP: School Feeding Programs

SHP: School Health Programs

SSA: School starting age

ST: Scheduled Tribe

WFP: World Food Programme

WHO: World Health Organisation

UN: United Nations

UNDP: United Nations Development Programme

Section A:

An evaluation of the National Program of Nutritional support to Primary Education in India

Chapter 1: Introduction and Review of Literature

1.1 Introduction and Motivation

Food for education programs are a popular policy instrument implemented in developing countries to achieve the Millennium Development goal of Universalization of primary education (Adelman et al. 2008; Afridi 2011; Bundy et al. 2009; Drake et al. 2016; World Food Programme, 2015).

Food for education programs or school feeding programs typically consists of the provision of food to school children, contingent upon enrolment and a minimum level of attendance. In most developing countries, these programs are provided free of cost or at a heavily subsidized rate. School feeding programs (SFP) adopt many different modalities to provide food to school children. These typically include: (i) School meals: could consist of either breakfast/fortified snacks or lunch served to students on school premises and are generally provided on a daily basis throughout the school year; (ii) Take home Food rations: generally consists of raw food grains (for instance-rice, wheat grains, cereal flour) which are distributed to students on a monthly basis or once per term, throughout the academic year conditional on enrolment and meeting a minimum attendance requirement.

The United Nations World Food Programme have advocated school feeding programs as they are extremely beneficial in a developing country context for the following reasons. First, children receive a nutritious meal on a daily basis, meeting some of the micronutrient needs, which are critical at the development stage of growing children. They help to build the nutritional foundation that is essential for a child's future intellectual development and physical well-being (United Nations, 2010). School meals, in particular, help to alleviate classroom hunger and boost concentration. Second, offering school nutrition programs, free of cost, act as a strong incentive to send children to school, lowering the marginal costs of schooling. Poor and credit-constrained households in developing countries, routinely invest less in education and nutrition than is privately or socially optimal (Adelman et al.

2008). SFPs are attractive as they subsidize the cost of schooling. Further school meals or food rations are a type of conditional in-kind transfers, which indirectly increases household income and directly raises the benefits of attending school.

Third, these programs are designed to act as a social safety net safeguarding vulnerable households and communities from economic shocks. They also provide protection in the form of food security in times of crisis or war (World Food Programme, 2013). It is estimated that these conditional in-kind transfers (school meals and food rations) provide a benefit per household of more than 10 percent of annual household expenditures for each child that participates in the program (Bundy et al., 2009).

As such, these SFPs have the potential to increase enrolment, school participation, reduce dropout rates and improve cognitive abilities and pupil achievement. Among undernourished children, these programs have the added bonus of improving total calorie intake and improving nutrient and health status. Further, they also help to reduce the risk of infections, by improving the nutritional and health status of children. Additionally, by encouraging children not only to enrol, but also to attend school regularly, these policies have the potential to curb child labour.

School feeding programs are also beneficial to local farmers as the food is usually sourced locally and may help promote sustainable local agriculture. In particular, these programs can help increase incomes of small-scale farmers and boost rural economies (World Food Programme, 2013). Other benefits of SFPs include the generation of gainful employment to cooks and other personnel involved in implementing these programs.

However, a major critique of these programs are that the full potential of nutritional gains generated by these programs may be abated among school-aged children as it lies outside the window of opportunity of early childhood, where the gains would be the largest. Further, these programs are more expensive compared to other programs aimed at increasing school participation. For instance, they are often more expensive than other programs that provide school inputs to increase school participation, and the nutrition benefits are small compared to those from nutrition programs targeting younger children.

The costs of implementing school feeding programs can run substantially higher than conditional cash transfer programs. Almost all school feeding programs must transport and store food, an inherently costly proposition. Programs that serve hot meals must also cook the food, which implies additional labor costs and the provision of at least minimal equipment and infrastructure for this purpose (Bundy et al., 2009).

In response to the criticism raised against SFPs, Adelman et al. (2008) notes, "although school-aged children are past the critical window of opportunity during early childhood for the greatest gains from good nutrition, increasing food and nutrient consumption among school-aged children with low baseline food energy or micronutrient intake can improve weight, reduce susceptibility to infection, and increase cognitive function in the short run. Because school meals are usually fortified, a child's micronutrient intake can improve even if her total calorie consumption does not. These short-run gains may improve a child's educational attainment and academic achievement, which can improve future welfare."

Further, proponents of these programs remark that resource-constrained governments should implement these programs by targeting poor schools located in rural and remote areas (Galasso and Ravallion, 2005; Alderman and Bundy, 2011; Lindert, Skoufias, and Shapiro, 2010). This would be cost-effective by reaching those that need these programs the most. Further, the benefits and impacts tend to be larger where there are significant nutritional deficiencies or where school participation is poor.

In spite of the costs and expenses involved in implementing school feeding programs, policy makers have increasingly come to recognize that the educational and nutritional benefits of these programs outweigh the costs. Governments in low-income countries have viewed these programs as conditional transfers that provide a social safety net and promote human capital investments (Alderman and Bundy, 2011). In most developing countries, these programs have been made available throughout primary school (Grades 1-7). However, they have not yet been extended to secondary school children, plausibly due to the expenses involved. Policy makers in developing countries have been taking the necessary steps to increase the coverage of these programs or to extend them to children in secondary schools.

1.2 Overview of School feeding Programs in developing countries around the world

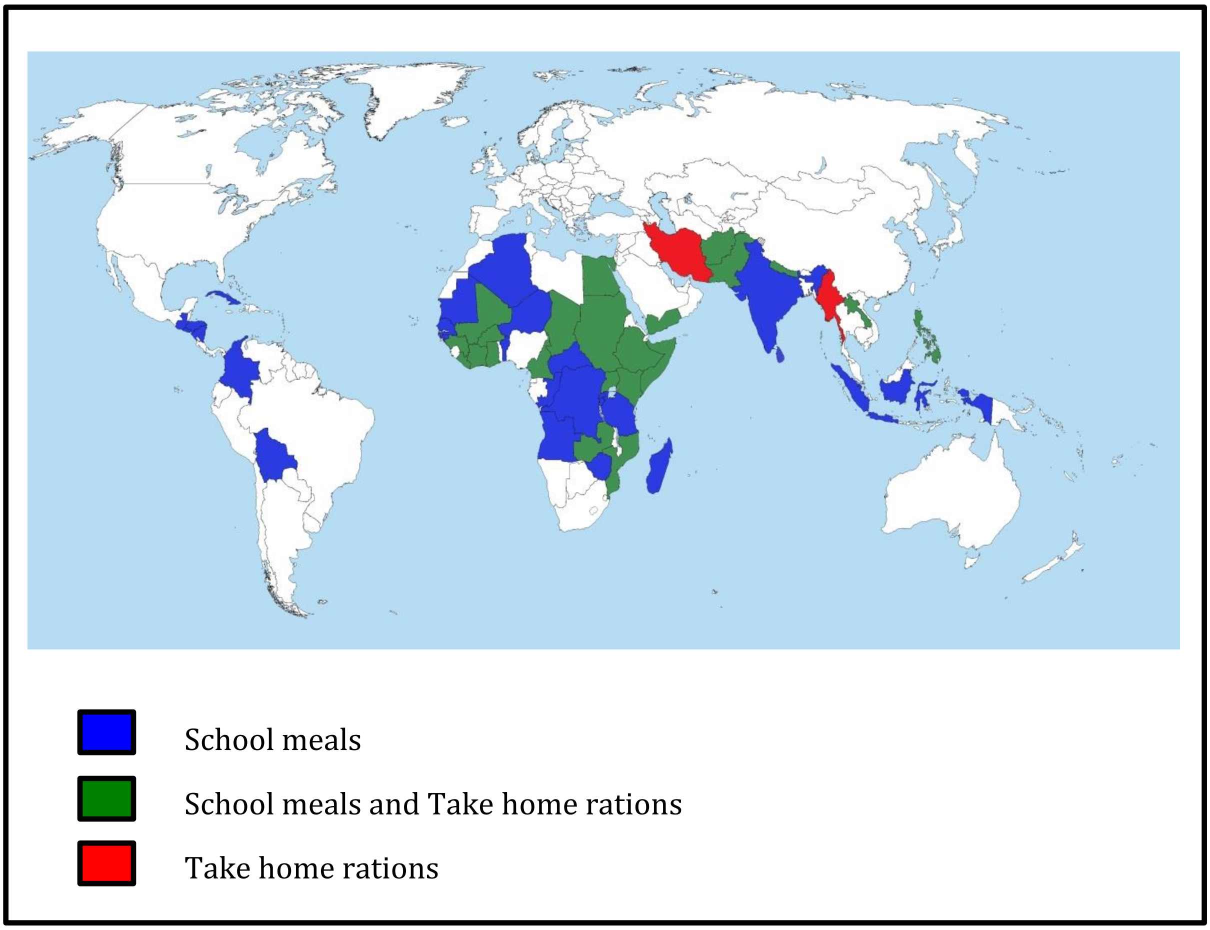
School feeding programs (SFP) have been in operation in various developing countries across the world since the 1960's (Levinger, 1986).

At present, the United Nations World Food Programmme (WFP) is the largest international implementer of school feeding programs in developing countries ranging from countries in Central and Latin America, Asia and Africa. Figure 1.1 illustrates the availability of these school-feeding programs in various developing countries in 2008.

The figure indicates that SFPs are popular policy instruments in developing countries. In 2008 alone, the WFP assisted 68 developing countries with over 102 million beneficiaries worldwide. Both school meals and take home rations were being provided in 19 developing countries in 2008. Take home rations in particular, are presently being provided in Myanmar, Iran and various countries in Sub-Saharan Africa.

In recent years, the World Food Programme has extended its coverage by providing school meals and food rations in refugee camps as well as in times of war, crisis and instability. The number of beneficiaries has been steadily increasing. An estimated 368 million children in 2013 received school meals on a daily basis and the global investment is in the order of US$75 billion a year (World Food Programme Report, 2013).

Figure 1.1 – Availability of SFPs across the world in 2008



Source: United Nations World Food Programme (2008)

Each of the different modalities of school feeding programs implemented in various low-income countries has their own advantages and disadvantages. We elaborate on these below.

First, in-school meals reach the intended beneficiary, while with take home food rations, the benefits may be spread/diluted within the beneficiary's household. Second, since school meals are provided on a daily basis, the program may be more effective in raising student attendance, unlike food rations, which are generally distributed on a monthly basis or once per term.[1]

[1] In many developing countries, the minimum attendance requirements are not strictly monitored and students receive food rations as long as they are enrolled in primary school (Bundy et al., 2009).

Third, another merit of school meals is that it would be especially easy to fortify the meals with essential micronutrients such as vitamins, iron and iodine. This may prove more difficult with food grains. As such, school meals may be more effective in ameliorating micronutrient deficiencies in children relative to food rations. Fourth, the food rations program may be easily subject to misappropriation and corruption by government officials, compared to the school meals program.

Fifth, the school meals program has the potential to generate employment for cooks and additional personnel to cook and serve children the meals. As such, this could likely create gainful employment for women and others belonging to poor socioeconomic backgrounds and serve as a source of income for them.[2] The food rations program, on the other hand, doesn't require many additional employees, relative to the school meals program.

However, a demerit of serving in-school meals is that the teachers may be involved in administering the program and as such, this would cut short time spent teaching and student learning (Vermeersch and Kremer, 2004). Another demerit of the school meals program is that it is relatively more expensive to implement than the food rations program. This may be particularly important in a developing economy setting where Governments have limited resources. For the school meals program, the expenses include the wages and remuneration for cooks and other personnel, the cost of ingredients and condiments, in addition to the fixed cost of purchasing utensils, building kitchen, storage and pantry infrastructure. In view of these additional expenses, the take home rations program would be more cost effective.

An advantage of both programs is that they help support local agriculture, as the food is usually grown locally. This may increase income of small-scale farmers and promote rural economic growth. Further, since both types of

[2] For instance, the Government of India has provided a directive to the State Governments that priority should be given to disadvantaged persons when cooks are appointed. A large percentage of the cooks employed are women and come from underprivileged backgrounds (Dreze and Goyal, 2003).

programs are conditional in-kind transfers and not conditional cash transfers, they are less prone to corruption by Government officials.

However, a disadvantage of both programs could very likely be the increased class size resulting from the increased school participation in the short run, which could impede student learning. Another disadvantage of both programs could be the redistribution of food to other household members, away from the beneficiary child. Even when provided at school, food transfers can be diverted to other household members by taking food away from the beneficiary child at other meals. This practice could diminish the size of the transfer received by the beneficiary child, resulting in only a small net gain in the child's daily consumption (Adelman, Gilligan and Lehrer, 2008). However, empirical evidence suggests that a substantial share of the food provided through in-school meal programs is not redistributed away from the beneficiary child (Jacoby, 2002).

Prior research has found compelling evidence that the merits of both programs outweigh the demerits. In the next section, we provide a critical review of the related literature that studies the impacts of school feeding programs in developing countries.

1.3 Related Literature

We provide a detailed review of the related literature that studies the impacts of School feeding programs in developing countries. Evidence from the research literature indicates that the impacts of school feeding programs are multi-dimensional in nature, with the effects ranging from children's educational outcomes to their health outcomes and also extending to their labour force participation (the households' decision to engage in child labour).

Prior research has primarily concentrated on the impact of these SFPs on educational outcomes, specifically, primary school enrolment and attendance, academic achievement and cognitive performance. An overwhelming majority of these studies find positive enrolment effects and effects on attendance. However, the effects on academic achievement and cognitive ability are mixed. It is also worth mentioning that the evidence on the impact of these programs on school entry age and educational attainment, particularly school completion, are quite limited.

In terms of the health and nutritional effects of these programs, previous research has focused on whether these programs are effective in increasing the daily dietary intake of calories and micronutrients among the beneficiaries. Other studies have also investigated whether these programs have helped increase height and weight using standard anthropometric measures. In general, the health and nutritional impacts of SFPs have predominantly been positive in undernourished settings.

In this section, we survey the related literature and summarize the impact of School feeding programs, starting with educational outcomes, followed by the impact on child labour and finally, wrap up with the impact on health outcomes. We also offer some concluding remarks that demonstrate how the first section of this thesis (section A) contributes to the research literature and further offer potential avenues for future research.

1.3.1 Educational Outcomes

1.3.1.A. School Participation

Increasing school participation is the primary objective of school feeding programs in developing countries and is viewed as a catalyst to promote the achievement of universal enrolment in primary schools. Both school meals and take home food rations encourage children to enrol into school as they lower schooling costs and serve as a strong incentive for parents to send children to school. School meals are provided on a daily basis, which should in turn promote increased attendance. Most take home rations programs are offered under the condition that the child has attained a minimum attendance criterion and so these programs are also expected to boost attendance. Further these programs are also expected to prevent children from dropping out of primary school.

There is a general consensus in the research literature that these programs have a positive effect on school participation. We review these studies below.

Majority of the studies evaluating school feeding programs in the Indian context, have typically focused on the school cooked meals program and have completely overlooked the food rations program that were the precursor to the school meals. The only exception is Afridi (2011), which looks at the effect of the transition from the distribution of food grains to the provision of cooked meals in Chindwara district in Madhya Pradesh. Using a difference-in-differences estimation strategy, she finds a significant 12 percentage-point increase in attendance rates particularly among girls in Grade 1. However, she finds insignificant effects on enrolment levels.

By contrast, Jayaraman and Simroth (2011) use a large school level panel dataset, the District Information system for Education (DISE), containing information on nearly 500,000 schools in India, in order to estimate the large-scale enrolment effects of the provision of cooked meals. Their identification strategy involves the use of state level variation in the implementation of the program. Accordingly, they adopt a triple differences technique and find a 13% increase in enrolment in primary schools. They also find a striking 21% increase in enrolment in Grade 1.

Numerous field reports and inspection reports conducted also find an increase in enrolment as a result of the distribution of cooked meals based on information provided in school and household surveys. However, most of these reports do not identify causal effects of the program, rather they report single difference estimates of change in enrolment and attendance, following the introduction of the program from school records.

Khera (2006) reviews nine of these field studies focusing on the effects of the cooked meals. Majority of the studies report an increase in enrolment and attendance rates. In particular, one of these field studies by Jain and

Shah (2005) report an overall increase in primary school enrolment by 15% and a dramatic 36% increase in enrolment in grade 1 in 70 villages in Madhya Pradesh. They find that this increase is more pronounced for girls and in particular, girls belonging to either the Scheduled Tribe or Scheduled caste group. However, as mentioned earlier, these results cannot be interpreted as the causal effect of the program.

A recent working paper by Afridi et al. (2016) also find that the monthly average attendance rates increased by 3-4 percentage points as a result of a school feeding program implemented in Municipal schools in Delhi in 2003. They also report that the program effects varied by grade and menu composition, with the largest effects being observed for younger children and schools that offer diverse menus and those that operate in the morning shift rather than the afternoon shift.

With regards to the provision of school meals and food rations outside India, there is almost complete unanimity that these programs increase school participation. An earlier study by Powell et al. (1998) find attendance increased significantly from a randomised, controlled trial of serving breakfast to primary school children (Grades 2-5) in rural Jamaican schools, relative to the control group, which did not receive breakfast. This is consistent with the results of Jacoby et al. (1996); another experimental study that also finds increased attendance rates as a result of breakfast provision in rural Peru.

Vermeersch & Kremer (2004) also provide experimental evidence by evaluating the effect of a fully subsidized breakfast program on school participation in preschools in Kenya. Exploiting the fact that the program was randomly implemented in 25 preschools out of a pool of 50, they find a significant rise in school participation rates among children in the treated schools, relative to the control group. They also report that the program increased participation of both children who were previously enrolled (intensive margin) and children who would not have gone to school in absence of the program (extensive margin).

In a similar study conducted by the International Food Policy Research Institute on the effects of a school feeding program in rural Bangladesh in 2003, they find evidence of a 14% increase in primary school enrolment (Ahmed, 2004). On the contrary, McEwan (2012) finds no effects of a school-feeding program on enrolment in Chile. He remarks that this finding is expected, as primary school enrolment in Chile is universal.

Ahmed and del Ninno (2002) study the effect of a food for education program implemented in 1993 in Bangladesh. The program provided free monthly rations of food grains to households, conditional on enrolment of their children into primary school. Within program schools, student enrolment increased by 35% over the two-year period from the year before the program to the year after the introduction of the program. In the non-program schools, however, enrolment only increased by 2.5%. Additionally, they report that the overall rate of attendance is 70 percent in the participating schools and only 58 percent in non-participating schools. As households chose whether to participate in the program, they are unable to identify the causal program effects and as such, it is unclear to what extent this difference in enrolment and attendance rates can be attributed to the impact of the school-feeding program.

A more recent study by Kazianga et al. (2012) find an increment in enrolment ranging from 3-5 percentage points, resulting from a randomised trial in northern rural Burkina Faso where students in certain randomly chosen villages were provided with school meals and those in other villages were provided with take home rations. The take home rations, consisting of 10 kilograms of cereal flour, were only distributed to girls on a monthly basis, contingent upon having 90 percent attendance rate. On comparing the two programs, they find no evidence to indicate that one mode of transfer dominates the other. Their findings corroborate the results found by Alderman et al. (2012) who conduct a similar randomised evaluation in Northern Uganda. They find statistically significant positive effects on enrolment and attendance rates as a result of the school meals and take home rations program.

In addition to the positive enrolment effects of SFP's, these programs have also been effective in reducing the dropout rates from primary school. In particular, Ahmed & del Ninno (2002) study the effect of a food rations program in Bangladesh on drop out rates, by comparing drop out rates between beneficiary students and non-beneficiary students within schools that implemented the program. They find that 6% of the recipients of the food rations dropped out compared to 15% of non-recipients, within program schools. However, they are unable to argue that the effects are causal.

A subsequent study by Ahmed (2004), finds that participation in the school meals program in Bangladesh reduced the probability of dropping out by 7.5%. However, the results must be interpreted with caution, as he is unable to address the issue of selection bias arising from participating in the program.

Overall, these findings underscore the importance of school nutrition programs in developing settings as a way of facilitating increased school participation. The evidence is also suggestive that these programs assist in curbing dropping out from primary school. Next, we summarise the studies that assess the impact of SFPs on academic achievement and cognitive performance.

1.3.1.B Academic achievement

The main mechanisms through which school-feeding programs could improve scholastic achievement and cognitive performance is through improved nutrition and learning. The former operates through improving the nutritional status of the students by reducing classroom hunger through the provision of nutrient rich meals. This improved nutrition leads to better educational achievement as it improves the students' attention and concentration. Additionally, increased school participation (or analogously, reduced absenteeism) and increased progression within primary school, also contribute to the improved pupil achievement.

The evidence on the effect of SFP's on learning and cognition has been inconclusive. On one hand, Ahmed (2004) finds that a school meals program in Bangladesh led to a large positive effect on pupil achievement of fifth grade students. In particular, he finds that eligible children in participating schools outperform children in non-participating schools in terms of their test scores by 15.7 percent points. Eligible children also score 28.5% higher in Mathematics than students in the comparison group.

Another study that also finds positive effects of SFPs on scholastic achievement is by Kazianga et al. (2012). They find an increase in test scores for mathematics for girls in Burkina Faso, resulting from both the randomized school meals and take home rations program administered.

On the contrary, Ahmed & del Ninno (2002) reveal that the take home rations program in Bangladesh decreased the test scores of fourth grade students in program schools compared to comparison schools without the program. They assert that one of the plausible reasons for the negative effects was due to the overcrowding of classrooms from the increase in enrolment, generated by these programs, which may have an adverse effect on educational achievement.

Ahmed and Arends-Kuenning (2006) attempt to decompose the negative effect found by Ahmed & del Ninno (2002) in order to pinpoint the precise mechanism driving the results. That is, they investigate whether the negative effects on academic achievement was due to the over-crowding of classrooms or due to negative peer effects from the new incoming students (who would have not enrolled in the absence of the program) which influences the learning environment for all students.[3] In order to do so, they study the impact of the SFP on student learning of non-beneficiaries in the participating schools owing to the fact that only 40% of students in program schools were beneficiaries, whilst the remainder were non-beneficiaries. Their findings revealed that the program reduced test scores of non-beneficiary students relative to the beneficiary students. They conclude that

[3] They argue that the new incoming students who enroll because of the program come from poor socio-economic backgrounds and this would result in negative peers in classrooms, adversely affecting academic achievement of all students in the class.

the negative effect on student learning operated through peer effects rather than through classroom crowding effects.

Additionally, McEwan (2012) concludes that a SFP in Chile had no effect on test scores of fourth grade students by exploiting the discontinuous variation in the assignment of calories of the school meals to different schools. More specifically, he uses the fact that some schools provided meals containing 1000 kcal per student per school day, while other schools served meals containing 700 kcal or less per student, depending on their vulnerability index, which is computed as a weighted average of socio-economic and anthropometric indicators. Using a regression discontinuity design, McEwan finds no effect of the program on fourth grade language and mathematics test scores. Further, he finds no evidence that the program affected grade repetition. Consistent with the findings of McEwan (2012), Tan et al. (1999) also provide suggestive evidence that a SFP in Philippines did not influence student learning.

Vermeersch and Kremer (2004) highlight that an experimental SFP in Kenya led to higher curriculum test scores, but only in preschools where the teacher was relatively experienced prior to the program. In most cases, teachers spend a disproportionate amount of time administering the program, which in turn reduces teaching time and student learning. They also reported that the school meals led to bigger class sizes. With regards to the magnitude of effects, they document that the program led to an increase in test scores by 0.38 of a standard deviation in schools with experienced teachers. They further note "the oral curriculum test score for children in treatment schools where all teachers were trained prior to the program is 0.42 of a standard deviation higher than in comparison schools where none of the teachers were trained."

Similarly, Grantham-McGregor, Chang, and Walker (1998) show that in Jamaica, learning outcomes deteriorated in poorly organized schools following the introduction of a school breakfast program.

Furthermore, the impacts of these programs on test scores have not been uniform across different subjects. For instance, Powell et al. (1998) study the effect of an experimental school breakfast program on student achievement in rural Jamaica. Wide range achievement tests, which comprises of reading, spelling and arithmetic tests were administered to primary school children at baseline and end line. They find a significant effect of the randomised breakfast program on the arithmetic scores of younger children. However, they do not find any significant program effects on spelling and reading scores.

A related study that assesses the impact of a SFP in Argentina on student learning, finds only a partial improvement in academic performance of Language test scores, while the effects on Mathematics test scores were negligible and statistically insignificant (Adrogue & Orlicki, 2013). Also, Jacoby et al. (1996), finds that a randomised controlled trial of providing in-school breakfast to children in Peru, only improved performance on a vocabulary test.

Pertaining to the program effects on cognitive development, the effects have largely been positive. For instance, Whaley et al. (2003) study the impact of an experimental dietary intervention on cognitive development of school children in Kenya. They assess the impact of the program on cognitive performance using the Raven's Progressive matrices. They conclude that children supplemented with meat significantly improved cognitive performance relative to the comparison group, which received no supplements. Besides, children randomly supplemented with meat outperformed on tests of arithmetic ability relative to the control group.

A recent study by Afridi et al. (2013) studied the effect of the school meals provided on classroom effort by exploiting the extension of the program to middle school children in public schools in Delhi in 2009. Effort is measured in terms of students' performances in solving mazes of increasing difficulty in a given amount of time. Their findings indicate that the school meals significantly improved classroom effort of Grade 7 students.

By contrast, no effects were found by Vermeersch and Kremer (2004), who study the effect of a school meal program in pre-schools in Kenya on orally administered cognitive tests. They rationalise this lack of effects by suggesting that the program did not improve nutritional status sufficiently to improve cognition.

Correspondingly, randomly implemented school meals program and take home rations program in Burkina Faso did not affect cognition (Kazianga et al., 2012). They measure cognitive ability by administering Raven's progressive matrices tests and the revised Wechsler Intelligence Scale for children. However, these tests were only administered at end line, without any corresponding test at baseline. So, the study only reports the single-difference effects of the two programs between treated and comparison group. They argue that the lack of any effect on cognition could be due to the fact that cognitive abilities are more likely to be influenced by interventions, which target children less than two years old, while the brain is still at a developmental stage.

Adelman et al. (2008) surveyed the literature on the effects of SFPs on cognition and find that the gains are often greatest for children with low nutritional status at baseline.

Thus, to sum up, evidence from the research literature suggests that SFPs have the potential to improve academic performance if the program is executed efficiently, without displacing teaching and learning time. Hiring outside personnel to administer the program would relieve teachers of this extra duty, and more importantly, this would not disrupt teaching time. School administrations also need to respond to the increased enrolment generated by these programs, in order to prevent overcrowded classrooms, which prove detrimental to student learning. Additionally, largest gains in test scores and cognitive development may be found among malnourished children in a developing setting rather than adequately nourished children. So, carefully designing and implementing programs such that the nutritional needs of children are met proves worthwhile.

1.3.1.C Educational attainment

To our knowledge, no existing study has evaluated the long-term effects of SFPs on educational attainment, particularly secondary school completion or higher.

The only study, which comes close, is by Alderman, Gilligan and Lehrer (2012) who investigate the impact of two SFPs (school meals and take home rations) randomly implemented in Uganda, on progression to secondary school. Their findings indicate that both programs did not influence progression into secondary school. Rather the program encouraged children in Grades 6 and 7 to remain in primary school through grade repetition, instead of dropping out, in order to benefit from the program.

They also inferred that the two programs would lead to delayed completion of primary school. However, they do not explicitly test whether the two programs affected primary school completion. This is because they only observe children in Grades 6 and 7 repeating grades in primary school at the time of the endline survey and do not observe whether they went on to complete primary school. As such, they haven't been able to investigate the effect of the SFPs on secondary school completion either.

In the following section, we summarise the available evidence of the effects of SFPs on primary school entry age.

1.3.1.D School starting age

From the earlier section (1.3.1.A.), it is evident that school feeding programs are popular policy measures that attract children to enrol into school, in developing countries. These programs may also encourage children to start school as soon as they become eligible, at the legal enrolment age, in order to benefit from the program. Therefore, we should expect a positive impact of these programs on starting school at the stipulated age. However, the program may also encourage older children (who are past the legal enrolment age) to enrol into school in the short-run, who may not have enrolled in the absence of the program.

The effects of school feeding programs on school starting age have not been researched extensively. The only exception is the study by Alderman, Gilligan and Lehrer (2012) who evaluate the impacts of randomly assigned school meals and take home rations program on school starting age in Northern Uganda. Their findings indicate that both programs significantly reduced school entry ages, and the results were more pronounced for girls. However, their estimation strategy only uses single-difference estimates of the program impacts, rather than a difference-in-differences framework. That is, they only report the difference in school entry ages following the program implementation between the treated and control groups.

Further, they do not disentangle the net effect of the program on school starting age, to identify whether the interventions enticed older children (who are past the recommended school starting age) to enrol as well. Their results imply that the programs encouraged children to start school at a younger age, however this effect maybe underestimated by the possibility that the program also encouraged older children to enrol into school.

As such, the impact of SFPs on school entry ages has received little attention. Given the serious economic implications of delayed schooling, this thesis seeks to address this gap in Chapter 2. In the next section, we review the related literature on the impact of SFPs on children's labour force participation.

1.3.2 Child Labour

School feeding programs provide strong incentives to parents to send their children to school and so; these programs may be potent enough to reduce the probability of child labour in developing countries. This is indeed the case found by Ravallion and Wodon (2000), who find that a food-for-education program in Bangladesh reduced the incidence of child labour and increased the probability of school participation. They also reported that the gain in schooling was larger than the reduced incidence of child labour, as a result of the program.

However, the aforementioned study does not evaluate the impact of these programs on hours worked by children. Children may reduce hours worked in response to these programs or may shift away from certain economic activities towards others that are more accommodating or compatible with the school schedule. That is, children may choose economics activities that allow them to work after school-hours, following the program introduction. Kazianga et al. (2012) study this exact question in the context of two school nutrition programs (school meals and food rations) randomly administered in Burkina Faso. They do not find evidence to indicate that these interventions eliminated child labour, but instead altered the allocation of child labour. Children with access to these programs, particularly, girls and those with access to the take home rations program shifted away from on-farm labour and off-farm productive tasks. They explain that this adjustment in child labour, away from productive activities and towards domestic activities, as being due to the compatibility of the latter with school working hours.

Given the limited number of studies that assess the impact of SFPs on child labour, further research is required in order to investigate whether the findings by Kazianga et al. (2012) hold in other developing countries (i.e. the external validity of their results).

In the subsequent section, we present a methodical review evaluating the causal evidence of the impact of SFPs on health and nutritional outcomes.

1.3.3 Health and Nutritional outcomes

The evidence from the related literature have generally found positive effects of school feeding programs on health and nutritional outcomes including indicators of nutritional status such as the dietary calorie intake and micronutrient intake by children. In particular, Jacoby et al. (1996) find that a randomly administered, in-school breakfast program in Peru, led to significant increases in the dietary intake of energy, protein and iron among the treatment group relative to the control group.

Afridi (2009) is another study that evaluates the nutritional impact of a school feeding program in India. On collecting data on student's 24-hour consumption recall in Chindwara district in Madhya Pradesh, she exploits the randomness in whether the student's 24-hour food-intake recall was for a school day or non-school day. She finds that ''the daily nutrient intake of program participants increased substantially by 49% to 100% of the transfers.'' She further notes that ''For as low as 3 cents per child per school day, the scheme reduced the daily protein deficiency of a primary school student by 100%, the calorie deficiency by almost 30% and the daily iron deficiency by nearly 10%''.

A similar study by Ahmed (2004) studies the impact of providing fortified wheat snacks to children in Bangladesh, implemented by the United Nations World Food Programme. Similar to the methodology adopted by Afridi (2009), the nutritional impact of the program is assessed by collecting dietary intake data from a 24-hour recall of children on school days and non-school days. He finds that the program significantly raised calorie intake of participating children on school days. In particular, he finds that the program led to an increase in a child's total daily energy intake by 97%.

As such, these findings suggest that SFPs facilitate increased caloric intake and to a certain degree, help in reaching the recommended dietary allowance. School meals also provide a unique opportunity to easily fortify the meals with essential micronutrients required by growing children. Consequently, these programs are expected to ameliorate micronutrient deficiencies by increasing nutrient intake among susceptible children.

In terms of the impact of SFP's on micronutrient intake, Walter et al. (1993) finds that iron fortified snacks provided as part of the school lunch program in Chile, significantly increased hemoglobin concentrations among children receiving the fortified snacks relative to beneficiaries receiving un-fortified snacks.

Similarly, Murphy et al. (2003) study whether a child nutrition intervention was effective in alleviating micronutrient malnutrition among pupils studying in primary schools in Embu District, Kenya. They employ a randomized controlled design, where children in the three experimental groups received a vegetable stew (energy group), vegetable stew with milk (milk group) and vegetable stew with meat (meat group), respectively. The comparison group did not receive any food. Food and nutrient intake was measured by 24-hour recall surveys. They find that "intakes of vitamin B-12, riboflavin, vitamin A and calcium increased more in the Milk group than in the Control group". Similarly, "intakes of vitamin B-12, vitamin A, calcium, available iron and available zinc increased more in the Meat group" relative to the control group. However, they do not find any significant improvements in the total daily diet of the energy group compared to the Control group. Their results corroborate those of Siekmann et al. (2003), who also conclude that supplemental meat and milk provided using a randomized treatment design considerably reduced the high prevalence of vitamin B-12 deficiency among rural Kenyan school children.

Other studies in the literature have also found positive effects of school feeding programs on health outcomes, measured in terms of anthropometric indicators, namely weight-for-age, weight-for-height, height-for-age and body mass index.[4] School meals are expected to increase weight by increasing calorie consumption, with the effects being more pronounced for malnourished children at baseline. In-school meals are also more likely to have an effect on height in the long run, with no apparent effect in the short-run.

As a result of a school breakfast scheme in Jamaica, school children experienced small but significant improvements in height, weight, and body mass index (Powell et al. (1998)). Their results are consistent to those of Ahmed (2004), who also find an increase in body mass index of school-age children, owing to a school feeding program in Bangladesh.

[4] Body mass index is commonly defined as weight (in kilograms) divided by height squared, where height is measure in meters.

Grillenberger et al. (2003) adopt a randomized treatment design to assess the impact of a dietary intervention on anthropometric measures in schools in Kenya. Using a similar methodology to that of Murphy et al. (2003), children in certain randomly assigned schools were supplemented with meat, milk and energy supplement, while the remaining schools in their analysis received no supplement (comparison group). They find evidence that the supplementation led to an increase in weight, notably a 10% increase in weight compared to the control group. However, they do not find any improvements in height or height-for-age measures after 23 months of the supplementation.

Another related study is by Kruger et al. (1996), who investigates the impact of a randomised controlled trial of serving school children with iron fortified soup, consisting of 20mg of iron and 100mg of Vitamin C, combined with deworming tablets in South African schools. The control group in their study were also provided with soup, although unfortified, with no additional deworming medication. They find significant increases in height-for-age and weight-for-height Z scores among treated children. They also find increased haemoglobin levels among children with low iron stores at baseline.

Singh, Park and Dercon (2012) study the impact of a SFP on the anthropometric z-scores of primary school students in the drought-stricken state of Andhra Pradesh, India exploiting the fact that the school meals were not only provided during term-time but also provided during the summer vacation. They find that students affected by the drought in the four years prior to the study experienced a significant negative effect on their height-for-age and weight-for-age scores. However, they conclude that the benefits from the school meals more than offset the negative effects of the drought.

Other studies argue that the effect of these school feeding programs on health outcomes may be underestimated as the household may respond to the program by diverting calories during other meals, away from children that are recipients of the program.

Jacoby (2002) specifically studies whether a school-feeding program in Philippines generated an intra-household reallocation of calories in response to the said program. He collects data on children's daily food consumption by randomly administering a dietary recall survey on both school days and non-school days. He identifies the causal effect of the program by exploiting the fact that the interview date was exogenously determined, as children were interviewed randomly on both school working days and non-school days. As such, he compares each child's dietary caloric intake on school days and non-school days between schools offering the program to those in schools without a program. His first finding indicates that the program significantly raised caloric intake of participating children. His second finding reveals that parents did not withdraw calories at other meals consumed on the same day as the program. Thus, they do not find any evidence of within-household reallocation of calories in response to the program.

A related study by Afridi (2009), also finds no evidence to indicate that parents were redistributing nutrients between meals within a day, in response to the school meals program in India. She identifies this possible reallocation of nutrients within the household by disaggregating the total daily nutrient consumption of the child into intake during school and non-school hours in a given day.

On the contrary, in Guatemala, households responded to a nutritional program by reducing the caloric intake of children at home (Islam and Hoddinott, 2009). However, they remark that even though the quantity of food consumption at home declines, the quality of their diet may still improve substantially due to the nutrient-rich intervention.

Thus to sum up, these studies indicate that school feeding programs have led to increased dietary intake of calories and micronutrients, coupled with improvements in anthropometric measures in children. These programs would be more effective if targeted at more undernourished populations of children. Additionally, substituting nutrients and calories between meals within households, away from children receiving the school meals and food rations, defeats the purpose of these programs, which are intended to improve the nutritional and health status of children.

Concluding remarks

We briefly summarize the findings from the research literature. As described above in the previous sections, the impacts of school feeding programs are multi-dimensional in nature, with a variety of effects, ranging from educational outcomes, health outcomes to children's labour market outcomes.

Majority of the studies in the related literature have focused on evaluating the impact of cooked school meals programs. As such, the impact of distributing food grains has not been researched extensively. Only a handful of studies exist that study the impact of this type of in-school intervention. To our knowledge only two studies exist that compare these two types of interventions (the take home rations and the cooked school meals), namely the study by Kazianga et al. (2012) & Alderman et al. (2012).

Overall, there is a general consensus that these programs are successful in raising enrolment and attendance. This seems to indicate that these programs do indeed provide strong incentives to parents to send their children to school, as they lower schooling costs.

In addition to the positive enrolment effects of SFP's, these programs also have the potential to reduce drop out rates from primary school. Although no evidence exists on the impact on SFPS's on school completion, there is suggestive evidence to indicate that these programs have led to a decline in drop out rates from primary school and also led to an increase in grade repetition to prolong benefitting from the program. To some extent, these programs have also been effective in reducing the incidence of child labour.

The evidence on the impact of these programs on academic achievement has been inconclusive. While some studies do indeed find positive effects on test scores, others do not find any effect or find negative effects. The reasons behind the negative effect on student achievement are as follows: (i) The overcrowding of classrooms resulting from the increased enrolment, due to these programs (ii) Negative peer effects coming from new incoming students who enroll only because of the program, who would have not enrolled in the absence of these programs and (iii) Teachers are actively engaged in administering these programs, thereby reducing teaching and learning time.

The effects on health outcomes (measured by both calorific intake and anthropometric measures) have largely been positive. Further, these programs could potentially have positive externalities on the child's/beneficiary's family. For instance, these programs could have positive spillover effects onto the educational and health outcomes of the child's siblings and perhaps even extending to the labour force participation of the child's parents (plausibly through an income effect channel).

Very limited evidence exists on the effect of these programs on school entry age and primary school completion. We seek to address this gap in the following chapters.

Chapter 2: The Effect of School Feeding programs on Primary school starting age and enrolment: Evidence from India

Abstract

The Government of India launched the National Program of Nutritional support to Primary education in India in 1995. This school feeding program initially provided food rations to primary school children enrolled in Government schools, with varying degrees of coverage across districts. This chapter studies the effect of the food rations program on school starting age and enrolment, using the Participation in Education particulars of the 52nd round and the 64th round of the National sample survey. We exploit the district level variation in implementation of the program along with the within family variation in the exposure of the program using a difference-in-differences estimation strategy. We find that the program had a positive effect on starting school at the stipulated school entrance age and on primary school enrolment. Additionally, we explicitly model primary school entry age using a discrete time duration model to study the effect of the program on time to school entry with respect to the legal entry age. Consistent with the previous findings, we find that the program encouraged children to start school at the stipulated entry age.

2.1 Introduction:

School feeding programs are popular policy instruments adopted by many developing countries to achieve the Millennium Development goal of Universal primary education. These programs have had a great deal of success in raising enrolment and school participation in many developing countries (World Food Program Report, 2011). This is also supported by evidence from the research literature as discussed in Chapter 1 (Vermeersch & Kremer, 2004; Adelman et al. 2008; Afridi, 2011; Kazianga, de Walque & Alderman, 2012). However, the impact of these programs on age at entry into primary school has received little attention.

The age of entry into primary school has important implications. Firstly, delayed entry may result in delayed accumulation of human capital, which in turn affects academic achievement in the short run and labour market outcomes in the long run (Alfano et al., 2011). These views are supported by a recent paper by Jaekel et al. (2015), which suggests that delayed school entry could mean that children are missing out on learning opportunities "during the critical early years". They find that missing one year of learning opportunities was associated with poorer average performance in standardized tests administered at age 8.

In terms of the long run effects, Angrist and Krueger (1991) find that compulsory school attendance laws which not only dictates the legal exit age of students but also the school start age, compelled students to attend school longer, depending on their season of birth. Consequently, they find that students who began school at a younger age earn higher wages as a result of their extra schooling. In line with their findings, Black et al. (2008) also conclude that beginning school at a younger age led to a small positive effect on earnings.[5]

[5] Black et al. (2008) exploit the variation in the month of birth in order to estimate the impact of school starting age on labour market outcomes. More specifically, they exploit the administrative school starting rule in Norway, which states that children born in December start school a year earlier, compared to children born in January.

Second, school entry age may not only affect the labour market outcomes of the child in question but also affect their families. In particular, evidence from Barua (2013) shows that "maternal labour supply is very responsive to school entrance ages." Further, a child's school entry age could also plausibly determine the entry age of his or her younger siblings. Parents would be more inclined to send their children to school at the same entry age, and not delay entry age of one child relative to the other.

Third, school enrolment age also reflects the family's investment in a child's education in developing countries. Parents significantly invested in their children's education are less likely to delay entry into primary school, relative to the mandatory school starting age. Thus, understanding the factors that determine school entry age would be particularly relevant to policy makers who are considering changing the school entrance policies.

The related literature on school starting age has been mainly concentrated on developed countries. This paper studies the school enrolment age from the perspective of a developing country, India. Contrary to developed countries, individuals in developing countries are less likely to abide by the stipulated school entry age. According to the fifty-second round of the National sample survey conducted in 1995-1996, only 58% of children in India start primary school at the legal entry age.[6] Furthermore, the evidence on the impact of school-feeding programs on school entry age is quite limited. Thus, assessing whether these programs are effective in incentivising parents to send their children to school at the stipulated entry age proves worthwhile, from a policy perspective.

Lower schooling costs and increased incentives for parents to send their children to school are the main mechanisms through which school-feeding programs increase school participation and enrolment. Through improved nutrition, these programs have the potential to reduce absenteeism and alleviate classroom hunger.

[6] The remaining 42% of children consist of children who never enrol or have not yet enrolled in primary school (28%) and those who start school late, past the legal enrolment age (14%).

The impacts of school-feeding programs on school entry age are not entirely clear. Free school meals and food rations may attract children to enrol as soon as they become eligible, at the legal enrolment age. Conversely, these programs may also entice older children, who are past the legal entry age, to enrol into school, who would have never enrolled in the absence of the program.

Thus, the objective of this paper is to empirically estimate the impact of a school-feeding program implemented in India, on starting primary school at the legal entry age and enrolment.

The Government of India launched a national school-feeding program in 1995, namely, the National Program of Nutritional Support to Primary Education, "with a view of enhancing enrollment and attendance and simultaneously improving nutritional levels among children" (Government of India, 1995).

The policy was initially being administered by providing food rations to students on a monthly basis. More specifically, each student in a Government school received three kilograms of food grains per month, conditional on enrolment and a minimum of 80% attendance in a given month.[7] The program was implemented in a phased manner across districts.

In this paper, we study the effect of the staggered implementation of the food rations program on starting school at the stipulated age and primary school enrolment using two nationally representative household surveys, namely, the Participation in Education surveys from the 52nd round and the 64th round of the National Sample survey (NSS). These surveys are useful for the analysis in question as they explicitly contain information on school starting age and enrolment.

We adopt two methodological frameworks to estimate the program effects. First, we use a difference-in-differences (DID) technique, exploiting the fact that the timing of program implementation varied across districts, in

[7] In many states, this criterion of providing food rations to students who have met the necessary attendance requirements was not strictly enforced. In these states, students were provided food grain as long as they were enrolled in school.

addition to the variation in exposure to the program between siblings in a household. The younger siblings in our analysis are of primary school age, whereas the older siblings are 12 years or older, at the time of program implementation. So, we compare school entry ages and enrolment between younger and older siblings in households that reside in districts that started the program earlier (treated districts) to districts that implemented it later on (control districts).

We also attempt to disentangle the net effect of the food rations program on school entry age. More specifically, we attempt to assess whether the program raised the enrolment of older children, who are past the legal enrolment age and who enrol because of the program (i.e., the extensive margin). We do so by examining the effect of the program on ever being enrolled in primary school. The intuition behind this is as follows. Those who have ever enrolled into primary school consist of children who enter school on time and late entrants. If the estimated enrolment gains as a result of the program are larger than the program effects on starting school at the stipulated age, this implies that the program also encouraged older children to enrol.

As a second approach, we estimate a discrete time duration model to specifically model time to entry into primary school as a result of the food rations program. We define time to school entry with respect to the legal primary school entry age. The intuition for this is as follows. If, for instance, some students start school at age 6, the prescribed enrolment age while others start at age 11. This duration of 5 years of delayed entry is explicitly modelled. So, we estimate whether the program helped reduce the time to school entry.

An advantage of this methodology relative to the first approach is that we can explicitly account for right-censored observations. In our context, there are children who have not yet enrolled into primary school and hence, these observations are right censored in the data. Duration models enable us to deal with these.[8]

Our first finding from the DID approach suggests that the program had a positive and significant effect on starting school at the stipulated age. Younger siblings in the household, who were eligible for the program by residing in a treated district, were 11 percentage points more likely to start school at the prescribed age relative to older siblings with no exposure to the program. We do not find differential effects by gender. These results are robust to the inclusion of birth order effects.

Our second finding indicates that the program had a large positive and significant impact on ever being enrolled, with the enrolment gains as a result of the program being 7 percentage points larger, than the program effects on starting school at the legal entrance age. This implies that the program, to some extent also successfully attracted older children, who are past the legal enrolment age, to enrol.

Consistent with the findings described above, the results from estimating the discrete time duration model indicates that the program increased the probability of commencing primary school at the mandated age by 6 percentage points among eligible children. We also find positive program effects on enrolment of children aged between 7 and 10 (between one and four years past the stipulated school entry age).

This chapter is structured as follows. In the next section, we provide a brief description of the Indian education system and a background on school feeding programs in India. In the subsequent section, we present the research questions and the datasets to be used. Following the description of the datasets used, we describe the estimation strategies adopted. Lastly, we present the findings and discuss the implications of the results and briefly describe any threats to validity.

[8] For instance, we do not observe whether children who are 5 years old at the time of the survey, entered school at the stipulated age or not, due to the timing of the survey.

2.2 Background

2.2.1 Schooling in India

In this section, we provide a detailed overview of formal schooling in India. The formal education system in India comprises of seven years of primary schooling, followed by five years of secondary schooling. Primary education is further classified into Lower and Upper Primary education. Lower primary education consists of five years of schooling from Grade 1 to Grade 5, while Upper Primary education is comprised of 2 years of schooling from Grade 6 to Grade 7.

Majority of the primary and secondary schools in India are managed by the Government. According to the sixth All India Education survey conducted in 1993, the Government and Local bodies managed more than 92% of schools, while the remaining were privately managed.[9] However, in recent years, there has been a sharp increase in the number of private schools. According to the District Information system for education (DISE) report, approximately 23% of the schools in 2014 were privately managed (DISE, 2014).

At the time of program implementation in 1995, primary education in India was characterised by large variations in school starting age, low enrolment rates and high retention rates, accompanied by wide disparities between girls and boys, and between urban and rural areas and across states.

Net enrolment rates in primary school have been far from universal. In particular, the sixth All India Education survey (AIES) reports an overall net enrolment ratio in primary school of 64%, with significant gender disparities.[10] Net enrolment rates were 57% for girls in primary schools as opposed to 70.8% for boys. State-wise net enrolment rates are reported in

[9] Private schools in India consist of Private aided and unaided schools. The latter refers to wholly independent/autonomous schools, which are privately managed and funded. The former type of schools is also privately managed, but they receive financial aid from the Government (Goyal and Pandey, 2009).

[10] Net enrolment rates are defined as the ratio between enrolment in a particular grade and the total population of individuals in the corresponding age group. Here, net enrolment rates are defined for Grades 1 to 5.

Table 2.1. In terms of the urban-rural differential, the National Sample survey report (52^{nd} round) indicates that 63% of students were attending primary school in rural areas in 1995. This is in contrast to urban areas where 78% were attending primary school.

Additionally, the stipulated school starting age (SSA) in India varies by state, ranging from age five in some states to age six in others. See Table 2.2 for further details. However, in spite of the prescribed SSA, there is a lot of variation in the number of children who never attend school and also in school starting age by gender, religion and caste groups (see Table 2.3).

Further, drop out rates from lower primary school have also been very high and as such, primary school completion has been very low. Consequently, the net enrolment rates at the upper primary school level were 48% for girls and 65% for boys. According to the 52^{nd} Round of NSS, the main reason for dropping out or discontinuing studies are financial constraints faced by the household.[11]

Encouragingly, in the last two decades, India has made great strides in achieving universal primary education, with a corresponding decline in dropout rates and grade repetition rates. The Annual Status of Education Report (ASER) survey conducted in 2014 reports that 96% of children in the 6-14 age group are enrolled in school. The percentage of out-of-school children has gone down drastically from 30% in 1998 to 4.28% in 2009 (UNESCO, 2000; UNESCO, 2014).[12] Additionally, the District Information system for Education reports dropout rates of 4.34% and grade repetition rates of 0.73% for students studying in lower primary schools (DISE Report, 2014).

[11] The other reasons for dropping out from school or never enrolling in primary school include the poor quality of schooling, failure in school examinations and tests, or because the child is unable to cope with the material taught and falls behind. Additional reasons reported were that children were engaged in economic activity or children were attending to domestic chores.

[12] Out-of-school children refer to school age population not enrolled in primary school, either because they have never enrolled or because they dropped out.

In spite of the considerable progress made in achieving universal primary school enrolment, India faces significant challenges in terms of the learning levels of children and subsequently the scholastic achievement of children in primary schools. Alarmingly, the 2005 ASER report documents that "35% of all children in the age group 7-14 could not read simple paragraphs (Level 1 text) and close to 52% could not read a short story (Level 2 text)."[13] Further, 41% of those belonging in the 7-14 age range could not do a simple arithmetic problem.[14]

Additionally, there are also significant disparities in learning levels between children enrolled in private and public schools. In particular, a nationwide survey found that 65 percent of children enrolled in grades 2 through 5 in Government primary schools could not read a simple paragraph (Pratham, 2006).

Low learning levels at public primary schools are further exacerbated by the high pupil-teacher ratio, teacher absenteeism, poor school quality and the lack of adequate facilities and amenities available. A nationally representative survey found that 24 per cent of teachers in India were absent during normal school hours (Chaudhury, et al., 2005). With one in four teachers absent at a typical government-run primary school, only 45 percent of teachers were actively engaged in teaching at the time of the visit.

In the remainder of this section, we focus on discussing the characteristics of public schools in India. We preclude private schools from the discussion, as the National programme of nutritional support for primary education was exclusively implemented in public schools.

Education is available free of cost in India in that the tuition fees are not explicitly charged in Government schools. Nevertheless, each student may be liable to pay a fixed sum of money to the school as library fees, examination fees, development fees and other miscellaneous fees. Other

[13] Level 1 is the ability to read a small paragraph with short sentences with Grade 1 level of difficulty. Level 2 is the ability to read a 'story' text with some long sentences with Grade 2 level of difficulty.

[14] The Arithmetic problems administered by ASER consist of a simple two-digit mathematical subtraction problem and simple division problem (three digits divided by one digit problem).

education related expenditure includes the cost of school uniforms, textbooks, notebooks and stationary, in addition to the transportation cost incurred in traveling to school on a daily basis.

Government schools in India have strict quotas in place with regards to the admission of children from poor socioeconomic backgrounds and minorities, namely those belonging to the Scheduled caste, scheduled tribe and other backward classes social group. Seats are also reserved for children belonging to certain religious minorities (Gazette of India, 2009).

Students from low socio-economic backgrounds, namely those belonging to the Scheduled caste (SC), Scheduled tribe (ST) and Other Backward classes (OBC) groups are awarded with scholarships or stipends from the Government to cover education related expenses (Ministry of Human Resource Development, 2014). Additionally, students from underprivileged backgrounds also receive free or subsidized textbooks and stationary.

Public schools in India also strictly enforce quotas in relation to the appointment of teachers belonging to the SC, ST, OBC and minority groups. According to the 6th AIES, 52% of the teachers in lower primary Government schools belonged to the scheduled caste, scheduled tribe and other backward classes social group, while the corresponding figure for upper primary schools was 43.6%.

76.21% of teachers at Government schools are full-time permanent teachers with tenure, while the remaining are contract teachers, employed either in a temporary capacity or on an ad hoc basis. The percentage of female teachers employed in public schools at the lower and upper primary level are 31% and 25.74%, respectively. In terms of teachers' qualifications, 22.45% of teachers in public primary schools possess postgraduate degrees. Roughly 86% of teachers in public schools received teacher training. On average, public school teachers have 16 years of experience (NCERT, 2005).

The day-to-day functioning of the public schools are decentralised and are undertaken at the State level, by the corresponding Education departments. The syllabus and curriculum are set by the Department of Education by the respective states. The implementation of National programs is also delegated to the respective state governments.

Additionally, there is also some variation in the start of the academic year and school working days across states in India. For instance, the academic year runs from June to April in some states, while in others, it begins in April and ends in March. See Table 2.4 for further information on the start of the academic year and school working days at the state level (Ministry of Human Resource Development, Government of India, 2012).

2.2.2 Background: National Programme of Nutritional support for Primary Education:

The Government of India launched the National Programme of Nutritional support for Primary education or popularly known as the Mid-day meal scheme on 15 August, 1995 with the broad rationale of providing "nutritional support to primary education as an anti-poverty measure that would maximise enrolment, reduce dropout rates and alleviate food burden of the family while investing in the human resources of the future" (Ministry of Human Resource Development, 2002). The policy was initially launched in 2408 Blocks in the country with varying degrees of coverage.[15] Between 1996 and 1998, the scheme was extended to all the remaining blocks of the country, in a phased manner.

This policy mandated the provision of nutritious and wholesome cooked meals to all primary school children (Grades 1-5) enrolled in Government schools in 1995, free of cost, for a period of 10 months in an academic year.[16] As such, the state governments were given a two-year deadline to make the necessary arrangements to enforce this scheme and in the interim period, were required to distribute 3 kilograms of food grains per student

[15] The administrative sub-divisions of States are districts. The District sub-divisions are called Blocks. As of 2001, India had 28 states, 593 districts and 5763 Blocks (Census of India, 2001).
[16] The program was implemented in Public primary schools consisting of Government aided schools and local bodies schools.

per month conditional on enrolment and a minimum of 80% attendance during the month. However, even until 2001, most States with the exception of Tamil Nadu, Kerala and Gujarat, had not strictly enforced this scheme of providing cooked meals and were instead only distributing food grains to the students.[17]

The primary reason for noncompliance by the state governments in providing cooked meals was due to the lack of funding provided by the Central Government (Khera, 2006). The Central Government freely transferred food grains to the State governments. They even subsidised the transportation costs incurred while transferring the food grains from the local Food Corporation of India (FCI) warehouse to the Government primary schools.[18] However, the cooking costs were to be borne by the State Governments and no additional financial provisions were made by the Central Government.

As such, between 1995 and 2001, the Government schools distributed 3 kilograms of food grains per student per month, conditional on enrolment and a minimum attendance rate of 80% during the month in question.[19] Food grains provided consisted of either rice or wheat grains, depending on the state and were distributed on school working days. Students were eligible to receive the food rations for a maximum of 5 years, from Grade 1 up to Grade 5.

[17] Before becoming a national policy, the scheme was initiated in Chennai city in Tamil Nadu under the directive of the Chief Minister K Kamaraj in 1962-1963. Eventually, by 1984, most of the primary schools in Tamil Nadu were covered by this scheme. Similarly, Gujarat and Kerala also had a fully operational cooked Mid-day meal scheme in place in 1986 and in the early 1990's, respectively. See Figure 2.1 for the Map of India.
[18] FCI was set up in 1965 in order to maintain a satisfactory level of buffer stocks of food grains to ensure National Food Security and to safeguard the interests of the farmers.
[19] Majority of the states, namely Arunachal Pradesh, Assam, Bihar, Haryana, Manipur, Meghalaya, Mizoram, Nagaland, Punjab, Sikkim, Uttar Pradesh and West Bengal did not adhere to the 80% attendance criterion and were distributing food rations only based on the enrolment status of the children (Ministry of Human Resource Development, 2002).

Program Roll out

The food grains distribution program was phased in sequentially across districts. Table 2.5 presents the program roll out and coverage rates across districts, obtained from the Ministry of Human Resource Development and the Ministry of Rural Development, Government of India.

In its first phase, the scheme was introduced in 288 districts in August 1995. These districts were targeted first because a majority of them were situated in drought prone areas, flood prone areas, desert areas and tribal areas. Given the characteristics of these districts, the Ministry of Rural Development, Government of India had implemented the Employment Assurance Scheme in these districts starting from 1993, with the primary objective of providing gainful employment to workers in rural areas during the lean agricultural season.

As part of the second phase of the scheme, the program covered an additional 169 districts in 1996, as these districts had female literacy rates lower than the national average. In the final phase, the scheme was extended to the remaining 57 districts in 1998. As such, the program was fully operational in all blocks and districts across the country by 1998.

In 1999, the program was operational in 687695 schools across the country covering approximately 97 million children (Ministry of Human Resource Development, 2002). Table 2.6 presents the State-wise program coverage rates of primary schools and students in 1999.

Finance and Logistics

The food grains were made available to the State Governments, free of cost by the Central Government. The allocation of food grains to be supplied to the schools was made through the FCI. This allocation of food grains was made once every quarter. The District Collector was held responsible for the collection and transportation of food grains from the FCI warehouses to the Government schools. The quantity of food grains distributed depended on the number of students enrolled at the respective schools. The District Rural Development agencies were reimbursed by the Central Government for the transportation cost incurred in moving the food grains to the schools at the rate of Rupees 50 per quintal.

The Ministry of Human Resource Development was the nodal agency for the implementation of the scheme. At the state level, the Department of Education was in charge of implementing and monitoring the program. According to the Ministry of Human Resource Development (2002), the Government of India has incurred Rupees 40 Billion (roughly equal to US$ 923 million in 1999) between 1995 and 1999 towards the implementation of the program. This expenditure is approximately 0.28% of the Indian GDP in 1999.

Policy Transition

The significant delays in program implementation of serving cooked meals compelled the Government to take action. Consequently, the Supreme Court intervened in November 2001 by issuing a directive to the State Governments prescribing them, ''to implement the Mid-day meal scheme under which every child in every Government and Government aided primary school was to be served a prepared Mid-Day Meal with a minimum content of 300 calories of energy and 8-12 gram protein per day for a minimum of 200 days'' (Planning Commission, 2010).

In 2004, the revised guidelines of the scheme raised the earlier transport subsidy and also ensured that the cooking costs are to be borne by the Central Government at the rate of Rupee 1 per child per school day (Government of India guidelines, 2006). The Central Government also provided financial assistance towards the cost of cooking which involved the cost of fuel and remuneration payable to the cooking personnel and the cost of ingredients such as pulses, vegetables, cooking oil, etc. Further, the Central Government also financed the provision of essential infrastructure required for serving cooked meals, namely the construction of kitchens, purchase of cooking appliances and utensils.

Prior to 2004, the cooking costs were to be borne by the State governments and as such, most States were unable to finance the cooking expenses and so, they resorted to providing food rations instead of the cooked meals. As such, following the Supreme Court's intervention in 2001 and the extra financial assistance by the Federal Government, the program transitioned from the monthly provision of food grains to the daily provision of school meals. By 2006, the coverage of the program was nearly universal (Khera, 2006).

In April 2004, the new revisions of this scheme also called for the provision of meals in drought stricken areas during the summer vacation. In October 2007, the scheme was further revised and accordingly, students in Grades 6 to 8, enrolled in Government schools in 3479 Educationally Backwards Blocks in the country became eligible for the cooked meals. By April 2008, all upper primary school students in the remaining blocks became eligible. Following 2009, the cooking costs and transportation costs are periodically undergoing revisions by the Central Government in view of the rising costs.

In 2011, the Ministry of Health and Family welfare advocated the use of salt fortified with iodine and iron in the cooked meals. As of 2015, the use of Double Fortified salt has been incorporated into the Guidelines issued by the Government regarding Mid-day meal schemes (Ministry of Human Resource Development, 2015). More recently, some states have also initiated the provision of milk to students at the start of the school day.

At present, this program is the world's largest school feeding program covering 120 million students in 1.2 million schools across the country (Government of India, 2013).

2.3 Research Questions

The objective of this chapter is to investigate whether the food rations provided as part of the National Program of Nutritional support to Primary education had an effect on age at entry into primary school and on enrolment. We focus on school entry age as the main outcome of interest as school-starting age has important implications for human capital accumulation, as noted previously. Furthermore, school enrolment age also has wide reaching consequences within the family (Barua, 2013).

The effect of the provision of food grains on school starting age is not entirely obvious. On the one hand, we may expect to see students entering school as soon as they become eligible, so that they can take advantage of the take home rations program. Their eligibility depends not only on the prescribed school entry age in their respective state but also whether their district of residence has started implementing the program. In this case, we would expect to observe a positive effect of the program on starting school at the mandated age. On the other hand, older children, who are past the legal enrolment age, who would have never enrolled into primary school in the absence of the program are now incentivised to do so. Alternatively, we would observe no effect, if the program truly did not influence school starting age. As such, the effect of the program on school entry age is ambiguous.

Thus, studying whether students start school at the state-mandated age as a result of the take home rations program is an interesting policy question, which remains unanswered in the existing literature on the effects of school feeding programs in the Indian context. This can potentially be generalised to other developing countries where the stipulated SSA is not strictly enforced.

Further, we attempt to disentangle whether the program influenced children to enrol on time or if the program encouraged older children, who are past the legal enrolment age, to enrol into primary school. We do so, by investigating whether the program had an impact on ever being enrolled in primary school, which includes enrolling on time and deferred enrolment (enrolment past the legal entry age). We briefly elaborate on this below.

If the estimated program effect on starting school at the legal entry age is equivalent to the program effect on ever being enrolled, then we would infer that the program only encouraged children to enrol on time, without influencing older children to enrol. On the other hand, if the enrolment effect of the program is greater than the program effect on commencing school at the mandated age, this implies that the program encouraged both children to enrol on time and also enticed older children to enrol.

Additionally, by exploiting the duration analysis framework, we evaluate whether being eligible at any age during primary school (ages 5-11) as opposed to being eligible at the margin, at the legal entry age (ages 5-6) yield differential program impacts. The latter case enables us to identify the impact of the program, at the margin.

As such, this paper intends to contribute to the research literature that assesses the impact of school feeding programs on schooling outcomes. Given the scarcity of papers looking at the effect of these programs on school entry age, this paper seeks to address this gap, at least in the Indian context. Further, most studies in the research literature have focused on evaluating the cooked school meals program, while a handful of studies have estimated the impact of the food rations program.

Moreover, this paper also contributes to the literature on primary school starting age in developing countries, a topic that has received very little attention. Relative to other developed countries where compulsory schooling laws have been strictly enforced, there is a wide variation in primary school entry age in the developing world (Bundy, 2011). This may be of particular importance to policy makers.

2.4 Data

The main source of data for this paper comes from the Participation in Education surveys conducted by the National Sample Survey Organization. In particular, we make use of the 52nd round and the 64th round of the National sample survey (NSS). These nationally representative surveys are suitable for the analysis in question, as they include detailed information on school starting age and enrolment.

The 52nd round and the 64th round of the NSS datasets are made available by the Ministry of Statistics and Program Implementation, Government of India, with the former survey being conducted at the time of program implementation, between July 1995 and June 1996 and the latter between July 2007 and June 2008. All states and union territories have been included in these surveys. The 52nd round and the 64th round interviewed 72,883 and 100,581 households, respectively.

These nationally representative cross-sectional household surveys contain information regarding the educational status of individuals aged between 5 and 24 years at the time of the survey, along with their corresponding gender, age, religion, social group and district of residence.[20] Besides information on school starting age, these samples also contain information on enrolment status, that is, the grade that the individuals are attending at the time of the survey. We also observe whether students dropped out of school or whether they were never enrolled in formal education and their respective reasons for doing so. These samples also contain information on age, gender, district of residence and educational level for each member of the household.

We complement the NSS datasets with data on the timing of implementation of the National Program of Nutritional support to Primary education at the district level and block level, that have been kindly provided by the Ministry

[20] The combined NSS 52 and NSS 64 samples contain information on birth cohorts born between 1971 and 2003.

of Rural Development and the Ministry of Human Resource Development, Government of India.

In order to construct the final sample to be used for our empirical analysis, firstly, we exclude the states of Kerala, Gujarat and Tamil Nadu as these states implemented the program a decade prior to the other states. We also exclude all Union territories in our analysis, as they may not be comparable to the states. It must also be noted that we focus on rural areas and exclude urban areas.[21]

Secondly, we drop households with one child or no children, as the difference-in-differences estimation strategy depends on identifying program effects by comparing siblings within the household. Moreover, since our methodology relies on variation in exposure of the program within the family, we exclude households where both/all siblings are eligible for the program. We describe this in more detail in the next section.

Finally, we exclude cohorts born after 1994. The reason for this is as follows: Cohorts born in 1995 turn six years old in 2001, which coincides with the transition of the program from the provision of food grains to cooked meals in certain states in the country. As such, cohorts born after 1994 would become eligible for the cooked school meals. Since we do not want to confound the treatment effects from the take home rations and school meals program, we restrict the sample to cohorts born up to 1993.

Correspondingly, the final sample is comprised of 13,085 siblings. Descriptive statistics on those who start school at the prescribed age and those ever enrolled, by gender, religion and caste groups are presented in Table 2.7. 64% of the individuals in our sample start school at the prescribed entry age. Once we bifurcate by gender, we find that boys start

[21] A shortcoming of the NSS datasets is that they do not provide any information as to whether the children attended a private or a public school. This is pertinent to the analysis in question as only students enrolled in public primary schools were eligible to receive the take home rations. We address this issue by focusing on households residing in rural areas, as the proportion of private schools in the rural areas is low. According to the sixth All India Education survey in 1993, only 4.6% of the primary schools in rural areas were privately managed.

school at the mandated age slightly more than girls. We also find differences by religion and caste groups.

Similarly, we find that 74% of the children in our sample have ever been enrolled, which includes those who enroll on time and late entrants (enroll past the legal entry age). 76.6% of boys have ever enrolled into school, as opposed to 71.5% of girls. Once again, we find differences between caste groups and religious sects.

Figure 2.2 plots the histogram of school entry age for the cohorts born between 1971 and 1993 using NSS 52 and 64. As we can see, there is a wide variation in school starting age across the board, ranging from age 5 to age 12, with the majority starting primary school at age 5 and 6.

2.5 Methodology

We use two methodological approaches in order to estimate the program impact on school starting age. The first is a Difference-in-differences (DID) estimation strategy. Additionally, in order to explicitly account for children who have not yet started school at the time of the survey, we estimate a discrete time duration model. This is described in more detail below.

2.5.1 DID Approach:

2.5.1.1 Sources of Variation:

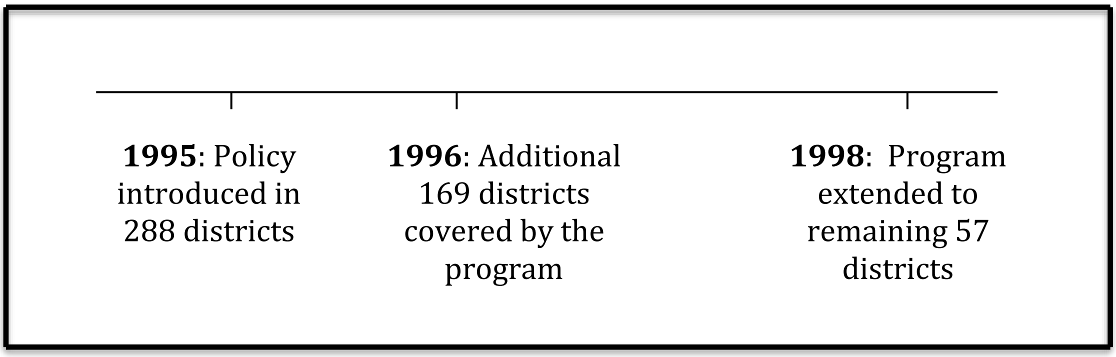
The timing of rollout of the food rations scheme was not randomly determined (described in the next section). We address this issue of endogeneity of program placement by exploiting the following 2 sources of variation inherent in our study: namely, the within-family variation in the exposure of the scheme among siblings in conjunction with the district-level variation in the implementation of the program. More specifically, we compare siblings within households in districts that received the program earlier (treated districts) to those that received it later (control districts). Accordingly, the econometric specification incorporates household and cohort fixed effects. We elaborate on this below. In subsequent sections, we also show that the treated and control districts follow the same trends in starting school at the stipulated age and enrolment.

2.5.1.1.A. District level variation:

As described in section 2.2.2, the timing of implementation of the program took place in a phased manner as determined by the Government (see Figure 2.3). In its first phase, the scheme was introduced in 288 districts situated in drought prone areas, flood prone areas, desert areas and tribal areas in August 1995.

As part of the second phase of the scheme, the program covered an additional 169 districts where the female literacy rates were lower than the national average in 1996. In the final phase, the scheme was extended to the remaining 57 districts in 1998. As such, the program was fully operational in all blocks and districts across the country by 1998.

Figure 2.3: Timeline of program rollout



Source: Ministry of Rural Development and Ministry of Human Resource Development, Government of India

2.5.1.1.B. Within-family variation:

The second source of variation that is exploited is the year of birth of siblings in the household. This is due to the fact that younger siblings in the household could have directly benefitted from the program if they were of primary school age at the time of the implementation of the program or if they started school after the program began, whereas older siblings would have no exposure to the program as they were past the primary school age or because they started school before the program was launched.

As such, the year of birth, the district where the household resides and the minimum state-mandated school starting age, jointly determines an individual's exposure to the program.[22] Siblings born between 1971 and 1993 are the cohorts under consideration in this study. A child born in 1990 was 5 years old in 1995. If the child was residing in a district where the program was fully operational in 1995 and met the minimum age requirements to start school, then this child would be eligible for the program in 1995. Similarly, a child born in 1983 was 6 years old in 1989 and was 12 in 1995. If this child started school at the state-mandated age or never enrolled in primary school, then this child would have no direct exposure to the program irrespective of the district that he or she resides in. As such, birth cohorts born at or after 1990 would have full exposure to the program, while birth cohorts born before 1990 would have partial exposure or no exposure to the program.[23]

This is in turn, verified by the 52nd round and the 64th round of NSS, which indicates that almost all children enrolled in primary school, start primary school before the age of 11, while 0.02% of children start school after the age of 11. As a result, the direct exposure to the program of children aged 12 years or older was very limited, which further lends support to the identification strategy.

Analogously, we consider a child who is of primary school age and who resides in a treated district as exposed to the program even if the child has

---

[22] Exposure refers to the child's eligibility for the food rations program. A child is considered as exposed if he/she resides in a treated district irrespective of whether the child actually receives the food grains by attending primary school. This is done because we are interested in the intention-to-treat effects of the program owing to the fact that we do not actually observe whether the child received food rations or not. This is discussed in more detail in the next section.

[23] Full exposure in this context refers to those children who have 5 years of exposure to the program, starting from Grade 1 until Grade 5. Partial exposure refers to those children who have 4 years of exposure or less. For instance, if the program were introduced when the child was in 4th grade, the child would have 2 years of exposure (in 4th grade and 5th grade).

never enrolled in formal education. This is done to circumvent the problem of selection bias. As such, we are interested in the reduced form, intention-to-treat effects of the program. This is discussed in more detail in the next section (2.5.1.2).

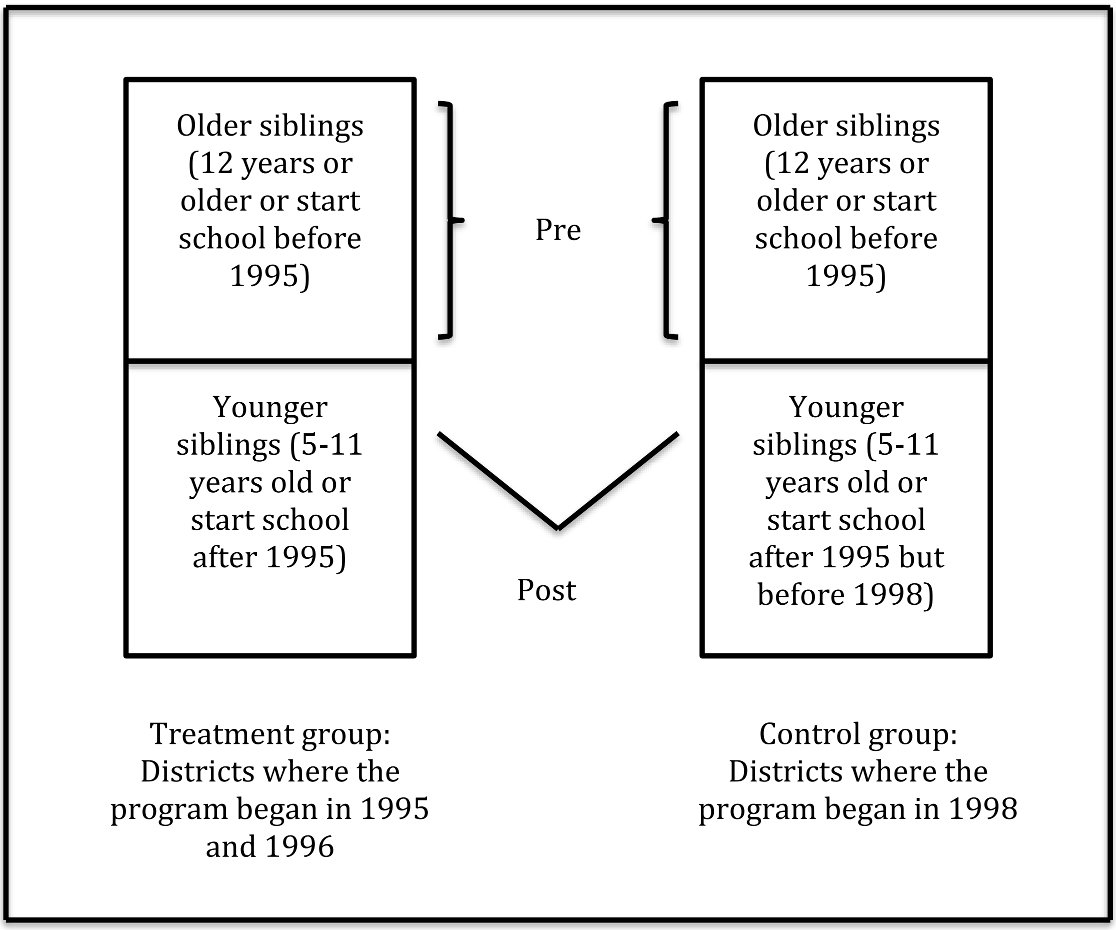
Thus, we exploit the fact that households in our sample consist of a mix of siblings belonging to different birth cohorts, with variation in the exposure to the program, at the time of program implementation. We describe the DID estimation strategy and the specification to be estimated in the following section.

2.5.1.2 Estimation strategy

In order to answer the research questions stated above, we use a difference-in-differences estimation strategy as it incorporates the two sources of variation inherent in our study, namely the timing of rollout of the scheme across districts as well as the within-family variation in the exposure of the scheme among siblings. Essentially, this empirical strategy enables us to identify the impact of the take home rations program by comparing younger and older siblings within households in districts that received the program earlier to districts that received the program later. This is illustrated in the following figure (figure 4.4).

As illustrated, we ensure that each household in the treatment and control group that is included in our analysis consists of at least one younger sibling that is of primary school age (Ages 5-11) and also contains at least one older sibling that is more than 12 years of age at the time of program introduction or those that started school prior to the commencement of the program.

Figure 2.4: Illustration of the Methodology adopted to estimate the program impact on enrolment and starting school at the stipulated age



Moreover, the above set up can easily be extended to households with more than two children. For instance, in a household with three children residing in the treated district, where the youngest and the middle child are of primary school age or if they started school after the program was launched; they represent the "Post-treatment" dimension. Whereas, the oldest sibling who is 12 years or older or if he started school prior to the program launch, represents the "Pre-treatment" dimension.

Next, we define the treated and control districts used in our methodology. We consider the districts where the scheme commenced in 1995 and 1996 as the treated districts and the remaining districts where the rollout took place in 1998 are the control districts. The rationale for choosing the above set of districts as the treated districts stems from the fact that the program was introduced on 15 August 1995. As discussed in Section 2.2.1, this does not coincide with the start of the academic year; rather it reflects the middle of the academic year in some of the states, where the school year begins in April.

Additionally, we exclude the cohorts that are fully exposed to the program in the control districts, since the program was also implemented in the control districts at a relatively later date than the treated districts. That is, we exclude children who are six years old or younger in 1998 in the control districts. Further, to maintain consistency, we drop their households from the analysis sample. Thus, we ensure that no individual in the control group is fully exposed to the program.

Pre-treatment characteristics for the treated and control districts are provided in Table 2.8. It has been constructed using cohorts that do not have any exposure to the program because they are 12 years or older at the time of program implementation. From the table we see that there appears to be negligible differences in the proportion of males between the treated and control districts. In terms of religion and caste groups, the treated districts have a higher proportion of Muslims and those belonging to the scheduled caste/scheduled tribe groups relative to the control districts. We also observe that the proportion ever enrolled and the proportion that start school at the stipulated age are significantly higher in the control districts, relative to the treated districts.[24]

It must be noted that we use the intention to treat (ITT) analysis throughout. This approach is adopted in order to address the issue of selection bias, as participation in the program was not mandatory for the students. Furthermore, the ITT analysis proves convenient, as we do not observe whether the children eligible actually received the food grains either due to truancy on the part of the students or non-compliance by the schools. Thus, we estimate the effect of being eligible for the program

[24] Although the pre-treatment characteristics differ significantly between the treated and control districts, this does not pose a threat to our identification strategy. This is due to the fact that we explicitly control for these characteristics in our estimating equation (see below), which also incorporates family fixed effects as we compare siblings within the family residing in the same district. Moreover, we show that the trends in the outcomes of interest are parallel for the treated and control districts in the following section.

(reduced form) and not the treatment effect on the treated as the latter suffers from the self-selection bias (Bloom, 1984). It must be mentioned that the intent-to-treat effect yields lower bounds on treatment effects.

Accordingly, in order to determine the magnitude and direction of the program effects, we estimate the following specification.

$$y_{ijdy} = \alpha + \delta(Treatment_d * Post_y) + \theta_y + \eta_j + \gamma_{sy} + \varepsilon_{ijdy} \qquad (1)$$

Where, y_{ijdy} is the outcome of interest for sibling *i* in household *j* in district *d*, belonging to birth cohort *y*. The variable $Treatment_d$ is an indicator for the Treated districts *d*. As such, it captures the districts that implemented the program in 1995 and 1996. *Post* is an indicator picking up whether the younger siblings in the family are of primary school age at the time of introduction of the scheme.

*Treatment*Post* is the interaction between the *Treatment* and the *post* variable. As such, it captures the children exposed to the program in the treated districts. Household fixed effects η_j, cohort fixed effects θ_y and state specific time trends, γ_{sy} have also been included. By including household fixed effects, this approach enables us to control for any unobservable differences within families that may drive school entry age and enrolment patterns.

The coefficient of interest is δ, as it is the difference-in-differences estimator that captures the change in the outcome of interest between the younger and older siblings in the family between the treated and control districts. Since the treatment was administered district-wise, we cluster standard errors at the district level.

In the next sub-section, we discuss the underlying identifying assumptions of the adopted methodology and test for whether it is satisfied.

2.5.1.3 Identifying Assumptions

The difference-in-differences estimation strategy relies on the crucial assumption that the trends in the outcome of interest are the same for the treated and control districts prior to the introduction of the program. As an initial check, we plot the trends of the outcome variables for each of the birth cohorts included in our analysis, separately for the treated and control districts. This is depicted in Figures 2.5 and 2.6. The cohorts under consideration are those born between 1971 and 1993. Cohorts born at or after 1990 in the treated districts would be fully exposed to the program. These birth cohorts represent the younger siblings of the family, who are of primary school age and would be eligible for the program in the treated districts. A child born in 1990 turns six in 1996 and so, this cohort would be eligible for the program at age 6 in the treated districts. By contrast, this same cohort would have no exposure to the program at age 6 in the control districts on account of the timing of the rollout of the scheme.

From figure 2.5, we see that the trends in commencing school at the mandated age are indeed parallel between the treated and comparison districts, for cohorts with no exposure to the program. Following the introduction of the program, we observe an increase in the proportion that started school at the legal enrolment age in the treated districts, particularly for the birth cohorts born at or after 1990.

Figure 2.6 plots the trends in primary school enrolment for the treated and control districts, against the different birth cohorts included in our analysis. Enrolment in this case refers to whether the child has ever enrolled in school, either on time or later. Once again, we find that the common trends assumption is satisfied, as the trends in enrolment for cohorts with no exposure to the program are parallel. Figure 2.6 also reveals a sharp increase in the proportion that have ever enrolled in primary school for the cohorts that are eligible to the program.

As a further check, we explicitly test whether the underlying assumption is satisfied for each of the outcome variables by estimating the following specification:

$$y_{idy} = \alpha + \sum_{y=1972}^{1993}\left(Cohort_y * Treatment_d\right)\delta + \theta_y + \mu_d + \gamma_{sy} + \varepsilon_{idy} \qquad (2)$$

Where, y_{idy} refers to the outcome of interest for individual i belonging to birth cohort y in district d. The treatment variable is an indicator for the treated districts. Consistent to what has been described earlier, we consider the districts where the scheme was launched in 1995 and 1996 as the treated districts and the remaining districts where the scheme commenced in 1998 are the control districts.

$Cohort_y$ are indicators for each birth cohort, while $Cohort_y$*$Treatment_d$ refers to the interaction between the cohort indicators and the treatment variable. The omitted category is the interaction between treatment and the cohort born in 1971, as this birth cohort has no exposure to the program. Equation 2 also includes cohort fixed effects, district fixed effects and state specific time trends. We cluster standard errors at the district level.

As such, we test whether the treated districts and the control districts follow the same trends in starting school at the stipulated age and enrolment, prior to the program introduction. That is, we test whether the coefficients δ are insignificantly different from zero or not, for the cohorts born prior to 1990.

The results from estimating equation (2) for each of the outcome variables are provided in Table 2.9. We find that the coefficients of interest are insignificantly different from zero for the birth cohorts with no exposure to the program. As such, no significant pre-intervention pattern is detected.

These results are encouraging as they offer support to the identification strategy. In the next section, we discuss the second methodology adopted in order to estimate the program impact on time to school entry.

2.5.2 Discrete Time Duration Model:

As a second approach, we use duration analysis to model time to school entry. This approach has many advantages compared to the DID methodology described above. First, duration models explicitly model the timing of school entry with respect to the legal school entry age. This is particularly relevant in our analysis as there is a lot of variation in school starting age in India (see Table 2.3). As such, we estimate a discrete-time duration model, as opposed to a continuous-time model since the school entry ages are intrinsically discrete.

Second, these models are well suited to incorporate right-censored data. In our context, there are children who have not yet enrolled into primary school and these observations are hence right censored in the data.[25] For instance, a child who is six years old and has not yet entered school at the time of the interview would be treated as a right-censored observation. We have incomplete information as to when this child enrols in primary school. Table 2.10 provides descriptive statistics on the number of right-censored observations present in our analysis. Third, we can incorporate time varying explanatory variables in the model (Allison, 1982).

As such, this discrete time approach of studying the time of school entry requires an expanded data structure, where each child contributes a sequence of observations for each age. This sequence begins at the stipulated school entry age and ends when the child enters school or not, in case of a censored observation.

In our empirical analysis, all durations are measured with respect to the legal primary school entry age. The observation window for each child in our sample contains at most 7 periods. That is, the observation window begins at the legal enrolment age. The next in the sequence would pick up

[25] NSS 52 and NSS 64 contain information on school entry ages of children aged between 5 and 24 years at the time of the survey. In addition, we also observe whether children have never enrolled or have not yet started school at the time of the survey.

the year following the stipulated school starting age and so on, until it ends with the period, 6 years after the legal enrolment age.

We assume the discrete-time hazard, $h_{ijd}(t)$ to be standard logistic model and estimate the following empirical specification:

$$h_{ijd}(t) = \frac{\exp(\lambda_t + \gamma_d + \delta\rho_{ijdt} + \beta x_{ij} + \alpha_{ijd})}{1 + \exp(\lambda_t + \gamma_d + \delta\rho_{ijdt} + \beta x_{ij} + \alpha_{ijd})} \quad (3)$$

Where, the dependent variable denotes the hazard or the conditional probability of entering school for child i in household j in district d at normalised age t, given that the child has not enrolled in school before. The normalised age t starts at the stipulated school starting age and can take any values from 1 to 7, as we restrict the length of the observation window to be at most 7 periods.

Thus, the dependent variable captures the duration of school entry with respect to the stipulated school starting age. In some states, the legal entry age is 5, while in other states it is 6 (see table 2.2). So, in this case, we normalise the stipulated school entry age across states and measure duration of school entry with respect to this normalised legal entry age. So a child with duration of one implies that the child started school on time. Analogously, a child with duration of two implies that the child started school one year after the legal school starting age. So, the dependent variable for this child would have two observations- taking the value of zero at the stipulated school starting age and a value of one the year after.

In case of censored observations, the dependent variable would be a sequence of zeros until the time of the interview. For instance, a child who is 8 years old and has not yet started school at the time of the interview would have a sequence of four zeros, if the legal enrolment age for the child in question is age 5. Similarly, a child who is 11 years old and has not yet started school would have a sequence of 7 zeros, if the child resides in a state where the stipulated starting age is 5 years old. This is another example of a censored observation.

Table 2.11 illustrates the possible values that the dependent variable can take, assuming that the prescribed school starting age is 5. This table can be generalised to the other states where the stipulated entry age is 6. In the empirical analysis, we normalise the legal school starting age across states.

From equation 3, the baseline hazard is denoted as λ_t. We allow this to have a flexible functional form by modelling it to be binary variables. That is, they are essentially indicators for the spell or the length of the observation window.[26] γ_d is a time invariant binary indicator identifying the treated districts. We consider the districts where the program was implemented in 1995 and 1996 as the treated districts and the remaining districts where the program was implemented in 1998 as the control districts.

ρ_{ijdt} denotes the program exposure variable for child i in household j in district d at age t. We define the program variable in terms of the district where a child resides and if the program was available at any age t for that child. Table 2.11 provides details on how the program eligible variable was coded. For instance, if a child resided in a district where the program was introduced when the child was aged 5 (the stipulated SSA) or younger, then the program variable would be one for this child, starting from age 5 (Case 1 in Table 2.11). Similarly, if a child resided in a district when the program was introduced when the child was 8 years of age (3 years past the legal entry age), the program variable would be zero for ages 5, 6 and 7, and would be one for age 8 (Case 4 in Table 2.11). In case of a censored observation-for instance, a child who is 7 years old and has not yet started school at the time of the survey and this child resides in a district where the program was implemented when the child was aged 5 – in this case, the program variable would be one for ages 5, 6 and 7 (Case 1 for Child ID 10 in Table 2.11).

Thus, we define the treatment group as those children residing in the treated districts. We define the program exposure group as those children in the treated districts and also if the program was available at any age during

[26] The spell in this context refers to the duration between the legal school starting age and the actual age the child started primary school.

primary school for these children. As such, δ is our parameter of interest as it captures the effect of the program on the hazard or the conditional probability of starting school.

We also control for background characteristics. In particular, x_{ij} is a vector of child and household characteristics. We include binary indicators for the child's gender, religion and caste group. As for the household specific characteristics, we control for household size, birth order dummies, distance to nearest primary school, main economic activity of the household and parental education. More specifically, we include dummy variables for whether the mother and father have completed primary school and secondary school or higher, respectively. Lastly, α_{ijd} refers to the child specific unobserved heterogeneity.

As such, the estimation of program effects relies on comparing the hazard of starting school for those children who are exposed to the program relative to children who have no exposure to the program.

As a cursory check, we plot the hazard or the conditional probability of school entry against the different ages for children in the pre-program period, separately for the treated and control districts in Figure 2.7. As described earlier, we normalise age in the figure, to start at the legal entry age. That is, age one refers to the legal enrolment age, while age two refers to the year following the legal entry age, and so on. Prior to the program introduction, the treated districts had a lower probability of starting school at the prescribed age, relative to the control districts.

Next, in Figure 2.8, we plot the hazard of school entry, following the program introduction, separately for the treated and control districts. Compared to figure 2.7, we find that the gap in the conditional probability of school entry between the treated and control districts has narrowed. We examine whether this effect is statistically significant in the results section below (section 2.6.2).

2.6 Results

We first provide the results from the difference-in-differences approach discussed in section 2.6.1, followed by the results from estimating the duration model described in Section 2.6.2.

2.6.1 Results from the DID Approach

2.6.1.1 School starting age

We first begin by estimating whether being eligible for the program had an impact on starting school at the stipulated entry age. To do so, we start by estimating equation (1) where y_{ijdy} is an indicator for whether sibling i in household j in district d starts school at the state mandated age and is zero otherwise.

The results from estimating equation (1) are provided in Table 2.12. We find that the program had a positive and significant effect on starting school at the stipulated age. In particular, younger siblings eligible for the program in the treated districts were 10 percentage points more likely to start school at the prescribed age than those with no exposure to the program (Column 1, Table 2.12).

Next, we allow for the possibility of heterogeneous program effects by gender in Column 2. We do not find any evidence of differential effects by gender. Thus, the program equally affected boys and girls in starting school at the mandated age and so; neither group was more likely to defer entry as a result of the program.

One concern is that we may very well be picking up birth order effects. That is, parents may treat the oldest child and the youngest child in the family very differently. In order to account for this, we include birth order dummy variables in Column 3 representing the second child, third child, etc. with the final dummy variable equal to one if the child is the sixth child or greater. The excluded category is the first child. The addition of these birth order effects does not change the sign of the program effects; neither does it change the magnitude by a large margin. We still find positive treatment effects and that the program did not differentially affect the school starting behavior of boys and girls.

Thus to conclude, we find that the program had a positive and significant effect on starting school at the mandated age. These results are mainly driven by the fact that the program provided an incentive to start school early in order to take advantage of the food grains provided.

2.6.1.2 Enrolment

From the previous section, the results indicate that the program encouraged more children to start school at the right age. However, this is just the net effect. It is underestimated by the possibility that the program encouraged late entrants (older children who are past the legal entry age) to enrol as well.

In this section, we attempt to disentangle the net effect by identifying whether the program had an impact on ever being enrolled in primary school. Those who have ever enrolled would consist of those who start school at the right age and those who start school at a later age. In effect, we try to answer the following question: whether the program encouraged older children, who are past the legal entry age, to enrol as well.

If we observe that the estimated program effect on ever being enrolled (at the legal enrolment age or a later age) is larger than the program effect on starting school at the right age, this implies that the program attracted older children to enrol as well.

On the contrary, if we observe that the estimated effect on enrolment is equivalent to the effect on starting school at the stipulated age, this would indicate that the program only encouraged children to start school at the right age and did not influence the enrolment decisions of older children.

Accordingly in order to disentangle the net effect, we estimate equation (1), where the dependent variable, in this case, is an indicator for those who have ever enrolled into school, which includes those who start school at the mandated age and late entrants. Analogously, it is equal to zero for those who have never enrolled into school. The results are presented in Table 2.13.

We find that the program had a statistically significant positive effect on ever being enrolled. In particular, those exposed to the program in the treated districts experience a 17.9 percentage point increase in enrolment, compared to those in the control districts (Column 1, Table 2.13). We also find differential program effects by gender. Girls enjoy larger enrolment gains compared to boys, though both effects are positive and significant.

These results help us disentangle the net effect of the program on school starting age as follows. First, the program was effective in encouraging children to enrol into primary school on time. Second, the program was also successful, to some extent, in raising the enrolment of older children, who would have never enrolled, but for the program.

2.6.1.3. Robustness Checks

2.6.1.3.1 Placebo Treatment using a DID approach

In this section, as a robustness check, we estimate the impact of a hypothetical treatment, which was implemented prior to the actual treatment. That is, we falsely assume that the program was implemented in 1990, five years before the actual treatment and test whether this placebo treatment has an impact on the outcomes of interest.

We focus on a sample of siblings born between 1971 and 1987, as they do not have any direct exposure to the actual treatment at age 6 in 1995. Consistent with the actual implementation of the program, we assume that this mock treatment was phased in sequentially. In the first phase, we assume that the program was launched in 1990 in the districts where the program actually began in 1995 and 1996. In the last phase, we assume that the program was extended to the remaining districts in 1993. We consider the former districts, as treated districts while the remaining districts are the control districts. In this case, cohorts born after 1984 in the treated districts were exposed to the placebo treatment at age 6 in 1990.

We identify the effect of this placebo treatment on starting school at the stipulated age and enrolment, by estimating equation 1. As before, we ensure that every household in the treated districts in our analysis, consists of at least one younger sibling exposed to the placebo treatment at age 6 and also older siblings unexposed as they are 12 years or older at the time of the placebo treatment. We include birth order effects, household fixed effects, cohort fixed effects and state-specific time trends. We cluster standard errors at the district level.

The results for this falsification test are provided in Table 2.14. We find that the difference-in-differences estimators are statistically insignificant for all the outcome variables, further validating our identification assumption.

2.6.1.3.2 Additional Robustness Checks using DID approach

Next, as an additional robustness check, we include district-specific time trends in our main specification (equation 1), instead of state-specific time trends. The results for each of the outcome variables are provided in Tables 2.A1 and 2.A2 in the appendix. We find that the results remain unchanged.

Thus far, the estimation results are based on standard errors clustered at the district-level. Lastly, as a further robustness check, we cluster standard errors at the household level in order to account for the arbitrary correlation of standard errors within clusters (households). The results are provided in Tables 2.A3 and 2.A4 in the appendix. We find that the inferences on all coefficients remain unchanged.

2.6.2 Results from the Duration Analysis

In this section, we present the results from estimating the discrete time duration model. We estimate equation (3) using the Maximum Likelihood estimation method, drawing on data from the 52nd round and the 64th round of the National Sample survey (NSS).[27] The marginal effects of the program impact on starting school at the stipulated age are provided in Table 2.15. The corresponding estimated Odds ratios are provided in the Appendix (table 2.A5).

Column 1 of Table 2.15 presents the baseline specification, which excludes birth order effects and state fixed effects. The results indicate that children exposed to the program were 6.2 percentage points more likely to start school at the mandated age, relative to those with no exposure. In column 2, we include birth order effects and we find that the program significantly raised the probability of starting school at the stipulated age. In particular, the program eligible group experience a 4.1 percentage point increase in the probability of starting school at the right age compared to the program-ineligible group, ceteris paribus.

Once we include both birth order effects and state fixed effects in Column 3, we find that children exposed to the program experience a positive and statistically significant increase in the probability of starting school at the legal entry age, relative to those children with no exposure to the program.

The coefficients of the binary indicators of the baseline hazard are negative and significant. The omitted category is the normalised stipulated school starting age across individuals. The results imply that children are less likely to start school at older ages, relative to the legal school starting age.

With regards to the child specific characteristics, we find that girls are less likely than boys to start school at the prescribed age. Further, those belonging to the scheduled caste, scheduled tribe and other backward class groups have a lower probability of starting school at the right age, compared to the other social groups. We also find significant differences across

[27] We estimate equation (3) using the “xtlogit” command in STATA 12. We allow for random effects at the child level.

religious groups- notably; Muslims experience a negative probability of starting school at the legal entry age relative to those belonging to other religious sects.

In terms of the family characteristics, we control for distance to the nearest primary school, which is coded as a binary indicator picking up whether the distance to primary school is more than 2 kilometres. From Table 2.15, we find that children residing beyond 2 kilometres from the nearest school are less likely to start school at the right age, compared to children living closer (less than 2 kilometres) to school.

We also control for the main economic activity of the household as a binary variable. We find that children belonging to an agricultural household are less likely to start school at the legal entry age, relative to children coming from non-agricultural households.

As expected, parental education significantly affects the probability of starting school. In particular, mother's educational level, particularly completing primary school or secondary school or higher has a greater positive influence on starting school at the prescribed age, compared to children whose mothers have less than primary education. Similar inferences can be drawn from paternal education- i.e. children's whose fathers have completed primary school or secondary school or higher are more likely to start school at the mandated entry age, relative to children's whose fathers education level is below primary education.

In column 4, we allow for heterogeneous effects by gender, by interacting the program eligible variable with the female dummy. We do not find statistically significant, differential program effects by gender.

Lastly, in column 5, we interact the program eligible variable with the normalised age dummies to allow for differential program effects across the different ages. As before, normalised age 1 refers to the legal school entry age. Normalised age 2 refers to the age following the legal entry age and so on. We find that the program-exposed children are more likely to start school at the legal entry age, relative to those with no exposure. Similarly, children exposed to the program are also more likely to start school at normalised ages 2, 3 and 4, relative to those children ineligible. This is illustrated in Figure 2.9, which plots the marginal effects of the program impact on starting school at different ages.

This implies, that the program not only encouraged children to start school at the right time, but also encouraged older children, who are past the legal enrolment age to enrol (between 1 and 4 years past the stipulated entry age), in order to benefit from the program. However, the program did not significantly affect the school entry decisions of children aged 10 and 11 (5 or 6 years past the legal entry age).

Next, as an extension, we evaluate whether children have a higher probability of starting school at the stipulated age, given that the program was available at the time of the legal entry age for that child. Accordingly, we use an alternative measure for the program variable. In this case, we define the program variable in terms of the district where a child resides and if the program was available at the legal school entry age for that child.

For instance, if a child resided in a district where the program was introduced in 1995 and the child was aged 6 (the stipulated SSA) in 1995, then the program variable would be one for this child.[28] Similarly, if a child resided in a district where the program was introduced when the child was 10 years of age, the program variable would be zero, since the program was not available at the legal entry age for this child. This child's parents would have made the decision to enter school, prior to the program implementation and therefore is considered ineligible.

[28] Children aged below 6 (stipulated school entry age) in 1995, residing in a district where the program was implemented in 1995 would also be considered eligible – as the program was in place at their respective legal school entry ages. For instance, if the program were introduced when the child was 4 years old, then the child would be eligible for the program, as the program would still be available the following year, at the legal entry age of that child. Similarly, if the program were introduced when the child was 5 years old, the child would be program-eligible. On the contrary, a child who is 8 years old in 1995 in a treated district and whose family had already decided whether or not to enter school when the child was 6 years of age would be considered as ineligible as they made the decision to start school prior to the program introduction, in the pre-program period.

So, we would like to see at the margin, whether children are more likely to enter school on time, given that the program was available at the stipulated entry age, in their district of residence. Table 2.16 illustrates how this alternative program variable was coded.

We present the results from estimating equation 3, using this alternative program variable in Table 2.17. The results presented in Table 2.17 are the estimated marginal effects (Odds ratios are reported in the Appendix- table 2.A6). In column 1, we present the baseline specification. In column 2, we include birth order effects. While, from column 3 onwards, we include both birth order effects and state fixed effects.

We find that the results are remarkably similar to those found in Table 2.15. The magnitude of the program eligible variable goes up, while remaining positive and statistically significant. This suggests that children who are eligible for the program at the stipulated school starting age, are more likely to start school at the legal entry age, compared to those who are eligible at older ages or those ineligible.

From column 1, we find that children who are program-eligible at the stipulated school starting age, experience an approximately 7 percentage point increase in the probability of starting school at the legal entrance age, relative to those who are ineligible or those eligible past the legal entry age.

The inference for all other coefficients remains almost unchanged. We continue to find that parental education, distance to nearest primary school, household's main economic activity, religious sect and social groups are significant determinants of school entry age.

As before, the indicators of the baseline hazard are negative and significant, implying negative duration dependence – i.e. the longer the duration with respect to the legal entry age, the less likely are children to enter school at older ages. Consistent with the results in Table 2.15, we do not find differential program effects by gender (Column 4).

2.6.2.1 Robustness Checks

In this section, we test whether our results are robust to some sensitivity checks. First, we allow the hazard to be a Complementary log-log discrete time hazard function (Jenkins, 2005). We do so, in order to check whether the results change if we change the functional form of the hazard function.

Discretizing a continuous time proportional hazards model gives rise to the complementary log-log specification. Complementary log-log analysis is an alternative to logit and probit analysis, but it is unlike these other estimators in that the latter are not derived from an underlying continuous distribution. Further, the complementary log-log discrete time hazard function is not symmetric with respect to its mean, whereas the standard logit model is (Narendranathan and Stewart 1991; 1993).

The results of the marginal effects of the program impact on starting school at the prescribed age are provided in Table 2.18. Once again, we find that the main results remain unchanged. The program effects are still positive and significant and the magnitude is similar to the findings in Tables 2.15 and 2.17. The inferences for all other coefficients also remain unchanged.

Next, as an additional robustness check, we allow for random effects at the household level, unlike in the results presented above, where we had allowed for random effects at the child level. This enables to see how sensitive our results are, by allowing for unobserved heterogeneity at the household level. The results are provided in table 2.19. We find that the results are very similar to that of Tables 2.15 and 2.17. We continue to find that the program effects are positive and significant, though the magnitudes are slightly larger. The inferences for all other coefficients remain unchanged.

2.6.3 Discussion

The results from the DID approach indicates that the program not only encouraged children to start school on time, but also enticed older children, past the legal entry age to start primary school, who would have not entered school at all, in the absence of the program.

The findings from the duration analysis also indicated that children who were eligible for the program at any point during primary school, were more likely to start school. In particular, if the program was in place at any time between the legal entry age and 4 years following the stipulated school starting age, then eligible children in the treated districts were more likely to start school, relative to those ineligible.

Further, we also find that the program had a sizeable impact at the margin, i.e. if the program was in place at the legal entry age of children, then children were more likely to start school on time, compared to children who were ineligible or eligible past the stipulated school starting age.

The results from our study are in line with the study by Alderman, Gilligan and Lehrer (2012). The above-mentioned study find that school feeding programs randomly administered in Uganda, led to an increase in enrolment by 9 percentage points for children who were not enrolled at baseline, but who had reached the recommended age of school entry. They further find that the in-school meals program led to a decrease in the age at entry into primary school. They do, however find varying program impacts by gender. In particular, the program effects are more pronounced for girls, relative to boys.

In our context, both approaches did not yield statistically significant heterogeneous effects of the program on school entry age, by gender. However, when we evaluated the impact of the program on ever being enrolled using the DID method, we find that the program had a positive and significant effect for both boys and girls, with the effect being more pronounced for girls. This implies that the program attracted more girls, who are past the legal entry age to start school.

Each of the 2 methodologies adopted in our empirical analysis have their own advantages and disadvantages relative to the other. We briefly discuss this below.

One of the demerits of the DID approach, is that we cannot explicitly account for right censored observations. We have incomplete information on the school entry age of those children who have not yet started school at the time of the survey. These observations reflect missing data and so we exclude them from the DID analysis. An advantage of the duration model is that it explicitly accounts for right-censored observations by employing the maximum likelihood estimation strategy.

Another advantage of the discrete-time duration model is that we can separately estimate the program effects at the different ages (i.e. for the ages past the stipulated school entry age- for instance, at age 7, 8 and so on). Further, duration models allow for random effects at the child-level, unlike the difference-in-differences methodology.

However, since we are estimating a random effects model under the duration analysis framework, we make a strong assumption that the unobserved heterogeneity is uncorrelated with the explanatory variables in the model. On the other hand, the DID approach which includes fixed effects estimators, allows for correlation between the unobserved heterogeneity and the covariates specified in the estimation equation.

2.7 Threats to Validity

In the remainder of this section, we briefly note down potential concerns and limitations that may bias the results. Firstly, we do not observe whether families migrated non-randomly to the treated districts at the time of rollout of the scheme, in order to take advantage of the food grains distributed. This non-random migration leads to the issue of selection bias. The 2001 Indian census reports indicate that migration in India in majority (roughly 67%) of the cases is characterized by migration from rural to urban areas or between urban areas. Since, we focus on rural areas, this does not appear to be a potential concern.

Unfortunately, we are unable to formally address this issue as we do not have district-level migration patterns at the time of program introduction.[29] The NSS employment surveys do collect information on migration, but these surveys were conducted 4 years following the program introduction. In particular, the migration surveys have been conducted in 1999-2000 (round 55) and subsequently in 2007-2008 (round 64).

Second, information on school starting age are self-reported and so, they may be subject to measurement error. Third, other policies that were implemented at the same time as the take home rations program would confound the results. As such, we would be unable to attribute the treatment effects solely to the take home rations program.

One of the policies that was prevalent at the same time as the take home rations program was the Employment Assurance scheme (EAS), which was implemented by the Ministry of Rural Development, Government of India starting from 1993 in the districts where the take home rations scheme commenced in 1995. EAS was fully operational in all rural districts by May, 1997. The scheme "aimed at providing assured employment for 100 days of unskilled manual works, to the rural poor who are in need of employment and seeking it," (Ministry of Rural Development Report, 1999). However, since EAS was operational in both the treated and control districts, we do not expect this concern to pose a major threat to our estimation strategy.

Another policy that was in operation across the country at the same time as the take home rations program was the Public Distribution System (PDS). This scheme ensured the distribution of essential commodities to the public at subsidised prices in order to strengthen food security for the poor (Ministry of Consumer Affairs, Government of India). The commodities distributed through fair price shops were wheat, rice, sugar and kerosene.

[29] The NSS education surveys used in this study only contain information on the district of residence at the time of the interview. They do not contain information on district of birth or how long the respondents lived in their respective district of residence.

This scheme was mainly targeted towards households who were below the poverty line. However, since PDS was functional in both the treated and control districts, we do not expect this to contaminate our results, as we do not believe that PDS differentially affected households between the treated and control districts.

2.8 Conclusion

In this chapter, we studied the impact of a Food rations program, the National Program of Nutritional support to primary education, implemented by the Government of India in 1995. The policy was initially implemented by distributing food grains to primary school students enrolled in Government schools. Students received three kilograms of food grains per month conditional on enrolment and a minimum of 80% attendance.

The related literature on school-feeding programs has typically focused on the effect of cooked school meals on school participation and scholastic achievement (Adelman et al., 2008). The studies that examine the impact of take home rations programs are quite limited. Additionally, the evidence on the impact of school-feeding programs on school entry age is scarce. Studying whether these programs are effective in ensuring that children enrol at the legal enrolment age is of particular relevance to policy makers. Moreover, the economic implications of delayed schooling may be quite large in a developing setting.

We estimate that the food rations program in India had a large positive and statistically significant effect on starting school at the legal enrolment age, using a difference-in-differences approach. Children exposed to the program in the treated districts benefit from an 11 percentage point increase in the probability of starting school at the stipulated age, relative to children in the control districts.

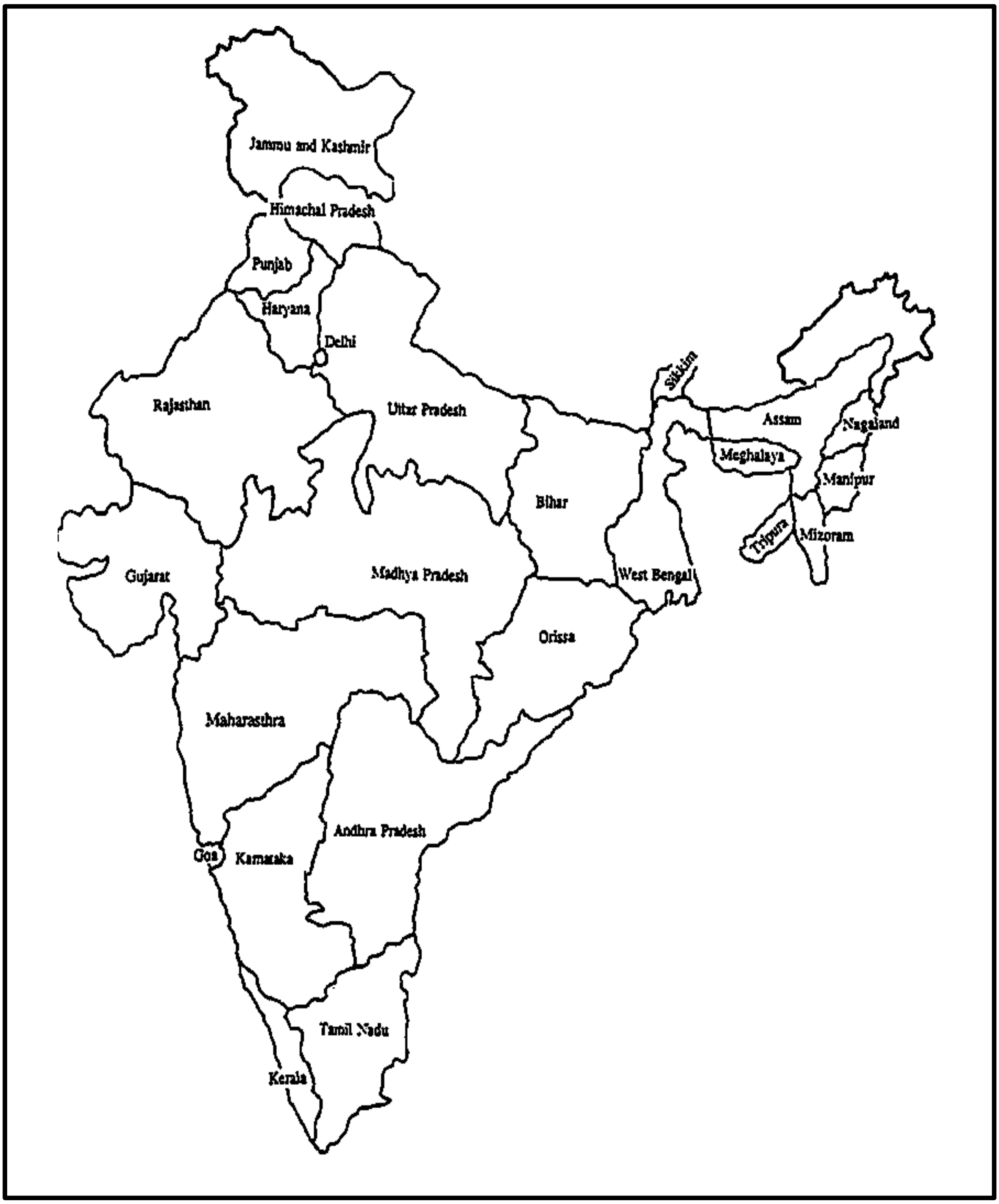
From these results, we infer that the program incentivised children to start school on time. However, this effect may be underestimated by the fact that older children, who are past the legal enrolment age, may also be encouraged to enrol into school as a result of the program. So, in order to disentangle these two opposing effects, we assess the impact of the program on ever being enrolled in primary school.

We find that the program had a large effect on enrolment (which includes enrolment on time and late enrolment). This implies that the program not only incentivised children to enter school at the right age, but also enticed older children to enrol as well, who would have never enrolled in the absence of the program.

In line with the results from the DID methodology, the results from the duration analysis also revealed that the program encouraged children to start school on time and additionally, also attracted older children, who are past the legal entry age to enrol.

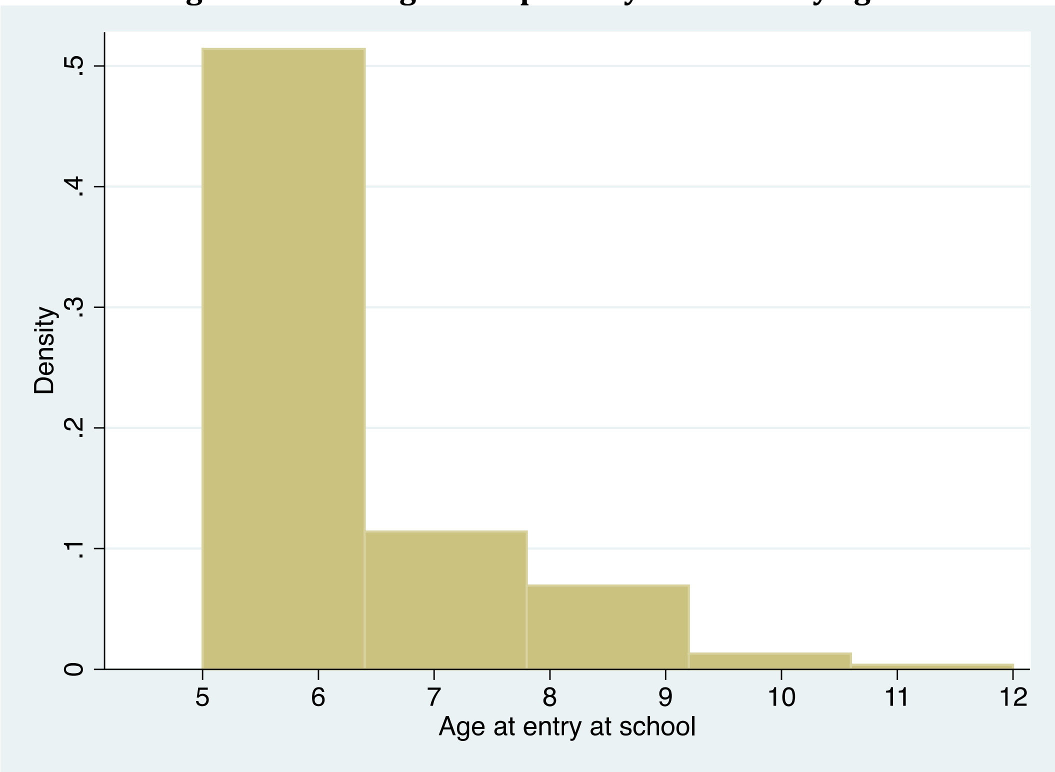
We conclude that school feeding programs are an effective strategy for attracting children to school and to ensure they enrol on time in developing countries. The impacts of these programs have important implications for future policies not only in the Indian context, but potentially, can also be generalised to other developing countries. In light of the positive enrolment effects generated by school feeding programs, future research may be inclined to study whether these policies do indeed reduce the incidence of child labour prevalent in the developing world.

Figure 2.1: India Map



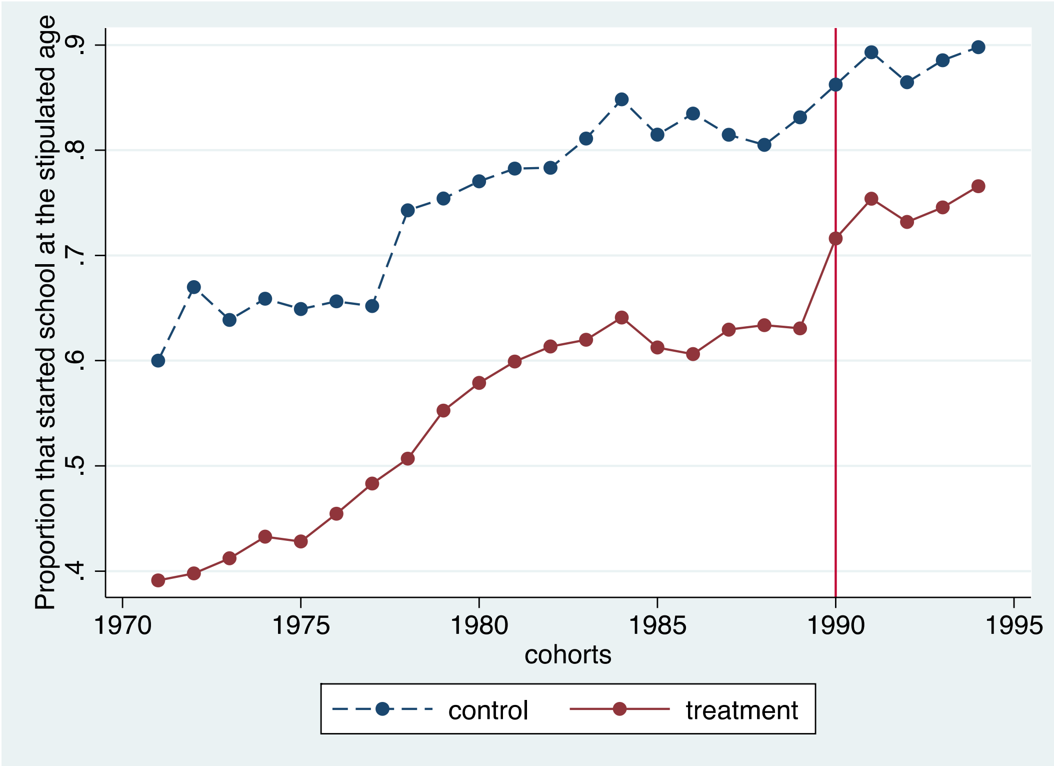
Source: Census of India, 1991
Note: Represents the map of India as of 1999. Post 2000, 4 additional states were created namely Jharkhand, Chhattisgarh, Uttarakhand and Telangana.

Figure 2.2: Histogram of primary school entry age



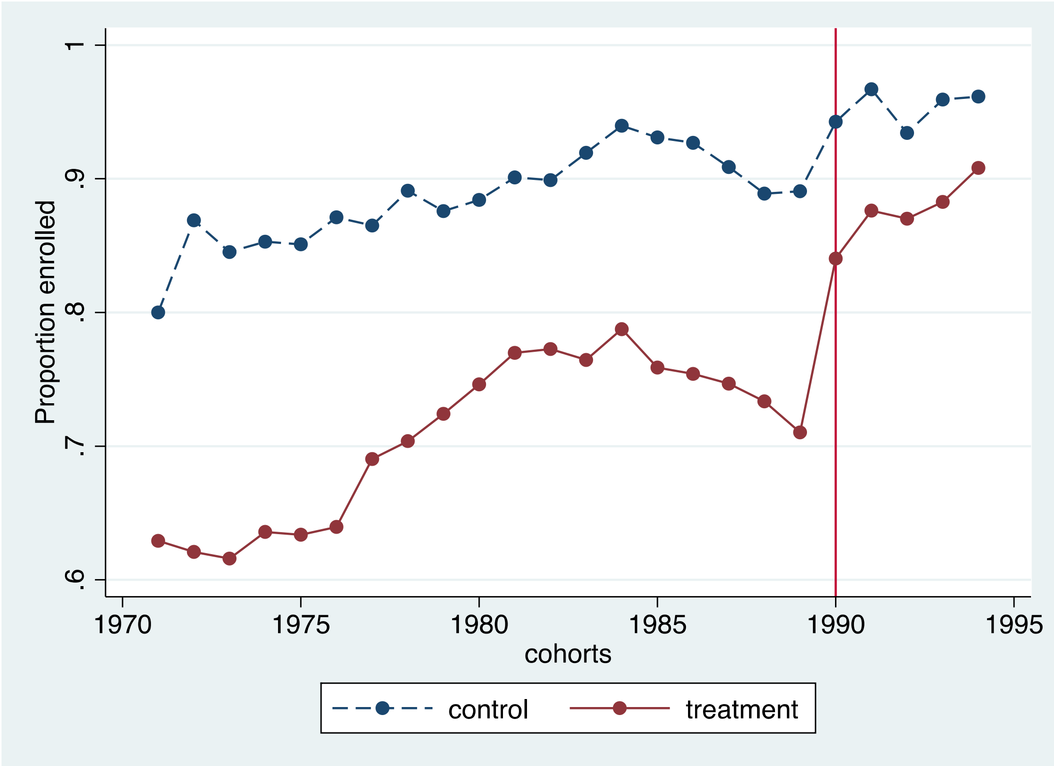
Notes: Figure 2.2 plots the histogram of Primary school entry age using the combined sample of the fifty-second and sixty-fourth round of NSS.

Figure 2.5: Trends in Outcome variable – Starting school at the stipulated age



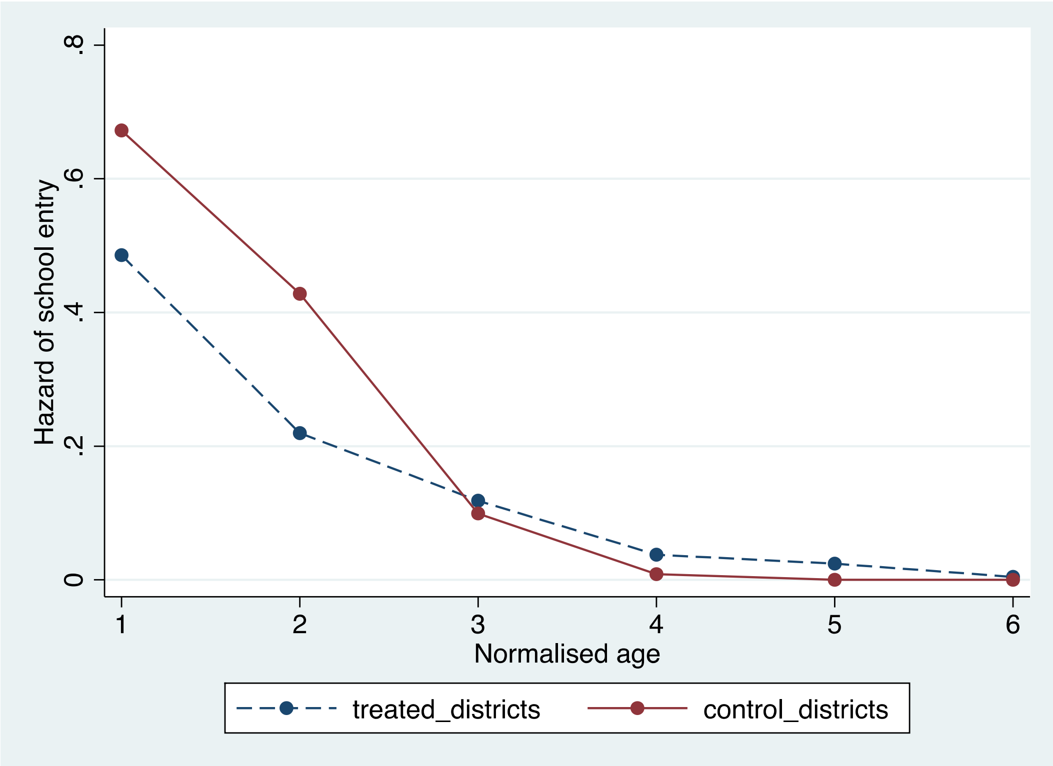
Notes: The figure plots the trends in starting school at the legal entry age for the different birth cohorts, separately for the treated and control districts. This has been constructed using the fifty-second and the sixty-fourth round of NSS. Cohorts born at or after 1990 are fully exposed to the program in the treated districts. All union territories and the states of Gujarat, Kerala and Tamil Nadu have been excluded. Households with one child or no children have been dropped.

Figure 2.6: Trends in Outcome variable – Enrolment



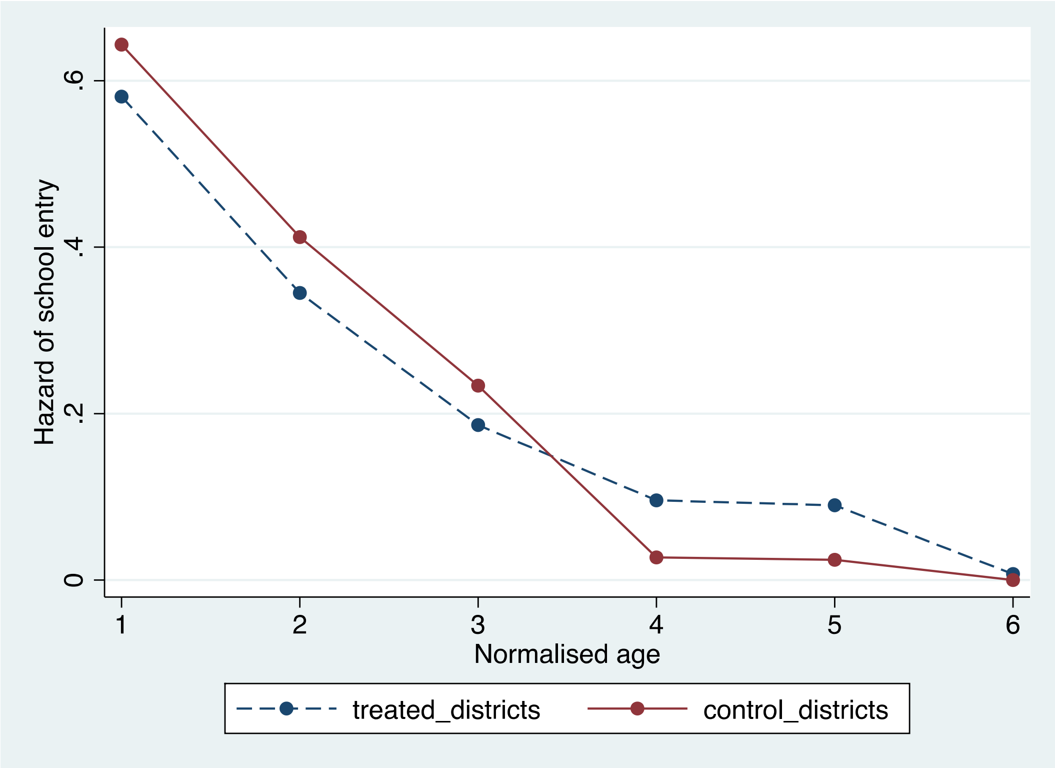
Notes: The figure plots the trends in ever being enrolled, separately for the treated and control districts. This has been constructed using the fifty-second and the sixty-fourth round of NSS. Cohorts born at or after 1990 are fully exposed to the program in the treated districts. All union territories and the states of Gujarat, Kerala and Tamil Nadu have been excluded. Households with one child or no children have been dropped.

Figure 2.7: Hazard of school entry, prior to program introduction



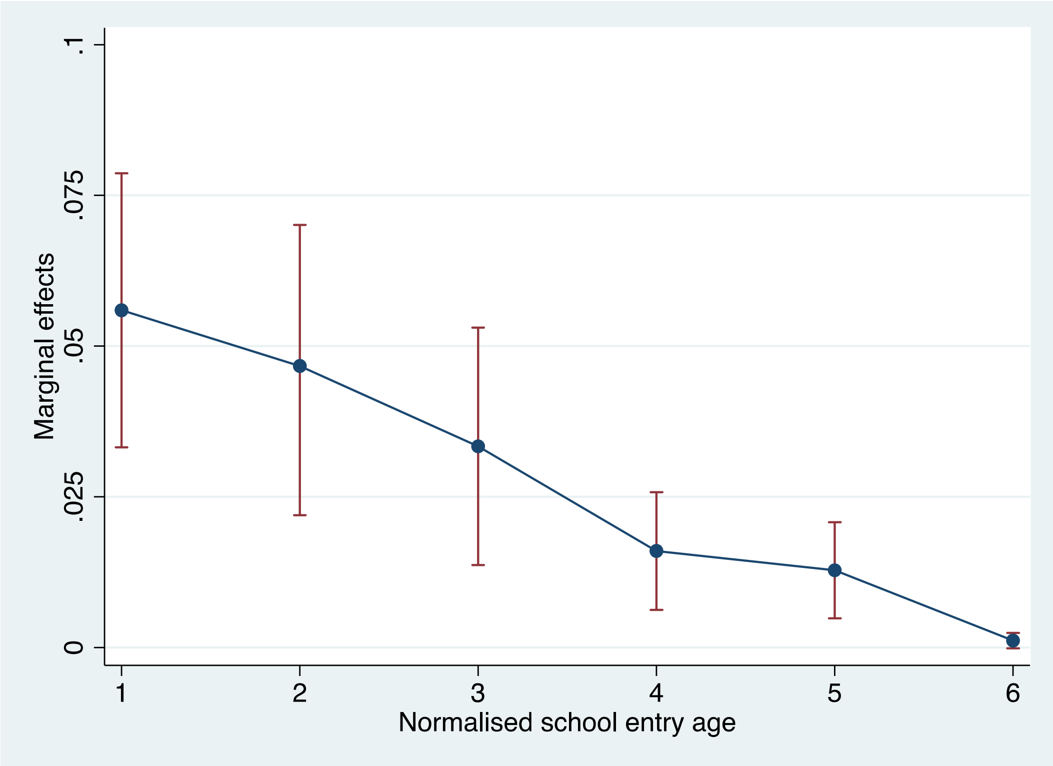
Notes: The figure plots the conditional probability of school entry prior to the program implementation, separately for the treated and control districts. This has been constructed using the 52nd and the 64th round of NSS. The normalised age refers to the normalised age of school entry. Normalised age 1 represents the stipulated school starting age. Normalised age 2 refers to the year following the legal school entry age, and so on.

Figure 2.8: Hazard of school entry, following program introduction



Notes: The figure plots the conditional probability of school entry, following the program implementation, separately for the treated and control districts. This has been constructed using the 52nd and the 64th round of NSS. The normalised age refers to the normalised age of school entry. Normalised age 1 represents the stipulated school starting age. Normalised age 2 refers to the year following the legal school entry age, and so on.

Figure 2.9: Marginal effects of the program impact on time to school entry



Notes: The figure above plots the estimates of the marginal effects of the program impact on time to school entry, for the different ages. The marginal effects have been estimated using the discrete-time duration model, using the 52nd and the 64th round of NSS. Normalised age 1 represents the stipulated school starting age. Normalised age 2 refers to the year following the legal school entry age, and so on.

Table 2.1: State-wise Net enrolment rates in primary schools in 1993

States	Male	Female	Total
Andhra Pradesh	63	54	58
Arunachal Pradesh	78	64	71
Assam	84	72	78
Bihar	77	47	63
Goa	80	77	79
Gujarat	81	71	76
Haryana	69	66	68
Himachal Pradesh	84	80	82
Jammu and Kashmir	60	44	52
Karnataka	83	73	78
Kerala	79	76	77
Madhya Pradesh	85	68	76
Maharashtra	73	68	71
Manipur	93	87	90
Meghalaya	55	57	56
Mizoram	81	74	77
Nagaland	48	46	47
Orissa	81	64	73
Punjab	74	71	73
Rajasthan	71	39	56
Sikkim	61	53	57
Tamil Nadu	80	76	78
Tripura	97	87	92
Uttar Pradesh	56	38	48
West Bengal	53	47	50
India average	71	57	64

Source: The sixth All India Education survey, September 1993, National Council of educational research and training, Government of India

Notes: Net enrolment rate defined as the percentage of children in the 6-11 age group enrolled in Grades 1-5 to the total population of children aged 6-11.

Table 2.2: State-wise Stipulated school starting age

State	Age 5	Age 6
Andhra Pradesh	x	
Arunachal Pradesh	x	
Assam	x	
Bihar		x
Chhattisgarh	x	
Goa	x	
Gujarat	x	
Haryana	x	
Himachal Pradesh	x	
Jammu & Kashmir	x	
Jharkhand	x	
Karnataka	x	
Kerala	x	
Madhya Pradesh	x	
Maharashtra		x
Manipur	x	
Meghalaya		x
Mizoram		x
Nagaland		x
Orissa	x	
Punjab		x
Rajasthan	x	
Sikkim		x
Tamil Nadu	x	
Tripura		x
Uttar Pradesh	x	
Uttarakhand	x	
West Bengal	x	

Source: Selected Information on school education 2011-2012,
Ministry of Human Resource Development, Government of India

Table 2.3: Age of entry into Primary school by gender, religion and caste groups

Panel A: School starting age by Gender (in percentage)

School starting Age	Female	Male	All
5	44.25	47.98	46.19
6	30.13	33.40	31.83
7	5.43	6.02	5.74
8 years and above	2.18	2.39	2.29

Panel B: School starting age by Religion (in percentage)

School starting Age	Hindus	Muslims	Others
5	48.51	36.83	42.12
6	31.37	34.13	32.00
7	4.98	5.75	11.58
8 years and above	1.63	2.52	7.06

Panel C: School starting age by Caste groups (in percentage)

School starting Age	Scheduled Caste and other backward classes	Scheduled tribe	Others
5	47.39	33.85	49.73
6	29.10	34.71	35.87
7	5.19	10.03	4.78
8 years and above	1.97	5.71	1.30

Source: Sixty-fourth round of National sample survey conducted between July 2007-June 2008

Notes: The percentages do not add up to 100, reflecting those children who have never enrolled or have not yet enrolled into school at the time of the survey (censored observations).

Table 2.4: Starting month of the Academic year by States in India

State	Academic year starting month
Andhra Pradesh	June
Arunachal Pradesh	July
Bihar	April
Chhattisgarh	June
Goa	June
Gujarat	June
Haryana	April
Himachal Pradesh	April
Jharkhand	April
Karnataka	May
Kerala	June
Madhya Pradesh	July
Maharashtra	June
Manipur	February
Meghalaya	February
Mizoram	January
Nagaland	January
Orissa	April
Punjab	April
Rajasthan	July
Sikkim	February
Tamil Nadu	June
Tripura	January
Uttar Pradesh	July
Uttarakhand	April
West Bengal	February

Source: Selected Information on School Education in India 2011-12, Ministry of Human Resource Development, Government of India

Table 2.5: District level coverage of the National Program of Nutritional support to Primary education between 1995 and 1998

State	Total Number of Districts	1995 Number of Districts covered	1996 Additional Districts covered	1998 Additional Districts covered
Andhra Pradesh	23	12	11	0
Arunachal Pradesh	12	12	0	0
Assam	23	21	0	2
Bihar	51	23	28	0
Goa	2	1	0	1
Haryana	19	6	7	6
Himachal Pradesh	12	4	3	5
Jammu & Kashmir	14	11	3	0
Karnataka	27	23	2	2
Madhya Pradesh	45	23	22	0
Maharashtra	30	16	2	12
Manipur	9	5	2	2
Meghalaya	7	7	0	0
Mizoram	3	3	0	0
Nagaland	7	7	0	0
Orissa	30	17	3	10
Punjab	17	5	2	10
Rajasthan	32	25	7	0
Sikkim	4	4	0	0
Tripura	4	3	1	0
Uttar Pradesh	81	19	62	0
West Bengal	18	6	5	7

Source: Ministry of Human Resource development and Ministry of Rural Development, Government of India

Table 2.6: State-wise coverage of the program across Primary schools and students in 1999

State	Public Schools covered by the program in 1999	Students covered by the program in 1999
Andhra Pradesh	54,248	7,618,122
Arunachal Pradesh	1,641	151,031
Assam	28,464	2,334,724
Bihar	53,220	9,353,231
Goa	1,202	83,784
Haryana	8,976	1,776,838
Himachal Pradesh	9,150	694,203
Jammu and Kashmir	8,407	620,364
Karnataka	41,577	5,658,630
Madhya Pradesh	87,909	9,007,942
Maharashtra	64,900	9,623,944
Manipur	2,997	254,585
Meghalaya	4,837	320,496
Mizoram	1,109	97,282
Nagaland	1,627	97,335
Orissa	40,132	4,496,999
Punjab	12,585	1,766,396
Rajasthan	41,564	5,534,862
Sikkim	1,490	84,986
Tripura	2,924	485,857
Uttar Pradesh	87,799	15,261,900
West Bengal	51,720	8,786,558
Total	608,478	84,110,069

Source: Ministry of Human Resource Development Report 2002, Government of India
Notes: The table excludes the coverage rates for 3 states (Gujarat, Kerala and Tamil Nadu), as figures are unavailable. All Union territories are also excluded.

Table 2.7: Descriptive statistics

Percentage who start school at the stipulated age	
All	64.3
Male	62.6
Female	59.92
Hindu	70.31
Muslim	57.29
Scheduled Caste and other backward classes	61.7
Scheduled Tribe	57.2
Percentage ever enrolled	
All	74.16
Male	76.66
Female	71.5
Hindu	79.32
Muslim	68.46
Scheduled Caste and other backward classes	69.69
Scheduled Tribe	65.41

Notes: The descriptive statistics reported above have been constructed using NSS 52 and NSS 64. The cohorts under consideration are those born between 1971 and 1993. Those ever enrolled consist of those children that have enrolled at the legal entry age as well those children who enrol late, past the legal entry age. The states of Gujarat, Kerala and Tamil Nadu as well as all the union territories have been excluded. Households with one child or no children have been dropped.

Table 2.8: Pre-treatment Characteristics

Characteristics	Treated districts	Control districts	Difference
Proportion who start school at the stipulated age	0.548	0.742	-0.194***
			(0.012)
Proportion ever enrolled in primary school	0.661	0.809	-0.148***
			(0.006)
Household Characteristics			
Male	0.517	0.508	0.009
			(0.004)
Hindus	0.755	0.772	-0.017**
			(0.007)
Muslims	0.125	0.085	0.040***
			(0.005)
Schedules Caste/Scheduled Tribe	0.193	0.264	-0.070***
			(0.006)
Father literate	0.52	0.65	-0.13***
			(0.051)
Mother literate	0.36	0.494	-0.134***
			(0.04)
Household size	6.17	5.94	0.23***
			(0.04)
Number of children in the household	3.63	3.58	0.05
			(0.09)
Distance to nearest primary school (km)	2.79	2.71	0.08
			(0.071)
Main economic activity:			
Agricultural household	0.673	0.534	0.139***
			(0.052)
Non agriculture	0.143	0.187	-0.044***
			(0.009)
Other labour	0.184	0.279	-0.095**
			(0.038)

Notes: The descriptive statistics reported above have been constructed using NSS 52 and NSS 64. The treated districts refer to the districts where the program was implemented in 1995 and 1996, while the control districts are the remaining districts where the program began in 1998. The states of Gujarat, Kerala and Tamil Nadu as well as all the union territories have been excluded. Households with one child or no children have been dropped. The cohorts in question are those born between 1971 and 1983 (those aged 12 years or above at the time of program implementation). The differences reported refer to the difference in characteristics between the treated districts and the control districts. We test whether the differences are significantly different from zero using the standard t-test. Standard errors are provided in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Table 2.9: Results from testing the identification assumption

	Enrolment	Enter at stipulated age
treated_district_1972	-0.058	-0.090
	(0.063)	(0.056)
treated_district_1973	-0.021	-0.065
	(0.060)	(0.053)
treated_district_1974	-0.020	-0.053
	(0.059)	(0.053)
treated_district_1975	0.005	-0.052
	(0.058)	(0.052)
treated_district_1976	0.029	-0.070
	(0.058)	(0.052)
treated_district_1977	0.042	-0.016
	(0.058)	(0.051)
treated_district_1978	-0.016	-0.026
	(0.057)	(0.051)
treated_district_1979	0.014	0.002
	(0.056)	(0.050)
treated_district_1980	0.020	0.016
	(0.056)	(0.049)
treated_district_1981	0.038	0.021
	(0.056)	(0.049)
treated_district_1982	0.050	0.027
	(0.056)	(0.049)
treated_district_1983	0.028	0.001
	(0.055)	(0.049)
treated_district_1984	0.009	-0.003
	(0.056)	(0.049)
treated_district_1985	0.026	-0.018
	(0.056)	(0.049)
treated_district_1986	-0.006	-0.019
	(0.056)	(0.050)
treated_district_1987	0.046	-0.007
	(0.056)	(0.050)
treated_district_1988	0.051	-0.001
	(0.056)	(0.050)
treated_district_1989	0.028	-0.028
	(0.056)	(0.050)
treated_district_1990	0.077	0.046
	(0.058)	(0.052)
treated_district_1991	0.083	0.053
	(0.058)	(0.052)

Note: Table continued

Table 2.9 continued: Results from testing the identification assumption

	Enrolment	Enter at stipulated age
treated_district_1992	0.099*	0.091*
	(0.058)	(0.052)
treated_district_1993	0.098*	0.080
	(0.059)	(0.052)
female	-0.026***	-0.046***
	(0.002)	(0.002)
District Fixed effects	YES	YES
Cohort Fixed effects	YES	YES
State specific time trends	YES	YES
Constant	0.417***	0.650***
	(0.019)	(0.017)
Observations	13,085	13,085
R-squared	0.155	0.125

Notes: The results presented are derived from estimating Equation (2) using the fifty-second and the sixty-fourth round of NSS to test whether the treated districts and the control districts follow the same trends in enrolment (Column 1) and starting school at the prescribed age (Column 2). We interact the birth cohort indicators with the treated districts indicator. The omitted category is the interaction between the 1971 cohort and the treated districts. We also include cohort and district fixed effects. Cohorts born at or after 1990 are fully exposed to the program in the treated districts. We cluster standard errors at the district level (*** p<0.01, ** p<0.05, * p<0.1).

Table 2.10: Censored observations

Age at time of survey	Number of Censored observations	Proportion of censored observations
5	1,629	0.324
6	692	0.283
7	294	0.122
8	348	0.057
9	161	0.012
10	327	0.025
11 and above	1425	0.109

Notes: This table presents the number of censored observations or the number of children who have not yet started school at the time of the interview using NSS 52 and NSS 64.The proportion of censored observations refers to the ratio between the number of censored observations at a particular age and the total number of observations at that age.

Table 2.11: Illustration of the dependent variable and program variable

Child ID	Age when child entered school	Dependent Variable	Program variable					
			Case 1: Program in place at or before legal entry age of the child	Case 2: Program in place 1 year after legal entry age of child	Case 3: Program in place 2 years after legal entry age of child	Case 4: Program in place 3 years after legal entry age of child	Case 5: Program in place 4 years after legal entry age of child	Case 6: Program in place 5 years after legal entry age of child
1	Legal entry age	1	1	0	0	0	0	0
2	One year after the legal entry age	0	1	0	0	0	0	0
		1	1	1	0	0	0	0
3	2 years after the legal entry age	0	1	0	0	0	0	0
		0	1	1	0	0	0	0
		1	1	1	1	0	0	0
4	3 years after the legal entry age	0	1	0	0	0	0	0
		0	1	1	0	0	0	0
		0	1	1	1	0	0	0
		1	1	1	1	1	0	0
5	4 years after the legal entry age	0	1	0	0	0	0	0
		0	1	1	0	0	0	0
		0	1	1	1	0	0	0
		0	1	1	1	1	0	0
		1	1	1	1	1	1	0
6	5 years after the legal entry age	0	1	0	0	0	0	0
		0	1	1	0	0	0	0
		0	1	1	1	0	0	0
		0	1	1	1	1	0	0
		0	1	1	1	1	1	0
		1	1	1	1	1	1	1
Censored Observations								
8	5	0	1	0	0	0	0	0
9	6	0	1	0	0	0	0	0
		0	1	1	0	0	0	0
10	7	0	1	0	0	0	0	0
		0	1	1	0	0	0	0
		0	1	1	1	0	0	0

Notes: This table presents how the dependent variable and the program variable were coded for the estimation of the discrete time duration model. In the above illustration, we assume that the legal entry age is 5. However, this can be generalised to the other states where the SSA is 6.

Table 2.12: Effect of the program on starting school at the prescribed age

	(1)	(2)	(3)
Start school at the stipulated age			
treatment_post	0.101***	0.117***	0.113***
	(0.025)	(0.034)	(0.034)
treatment_post_female		0.035	0.040
		(0.047)	(0.048)
treatment_female		-0.022	-0.025
		(0.025)	(0.025)
post_female		0.105**	0.111***
		(0.042)	(0.043)
female	-0.056***	-0.056**	-0.055**
	(0.009)	(0.023)	(0.023)
Cohort Fixed effects	YES	YES	YES
Birth order effects	NO	NO	YES
Family Fixed effects	YES	YES	YES
State specific time trends	YES	YES	YES
Constant	0.576***	0.589***	0.569***
	(0.056)	(0.056)	(0.069)
Outcome mean (pre program)	0.643	0.643	0.643
Observations	13,085	13,085	13,085
R-squared	0.084	0.086	0.093
Number of households	3,747	3,747	3,747

Notes: We use NSS 52 and NSS 64 to test whether the program had any effect on starting primary school at the stipulated age using the DID methodology. The cohorts under consideration are those born between 1971 and 1993. The dependent variable is an indicator picking up whether the child started school at the stipulated age. Treatment is an indicator for the treated districts. Post is an indicator for the younger siblings in the family. In column 2, we allow for the possibility of heterogeneous treatment effects by gender. In column 3, we allow for birth order effects by including an indicator for the second child, third child, etc. The excluded category is the first child. Outcome mean reports the mean of the outcome variable in the pre-program period. The standard errors are clustered at the district level (*** p<0.01, ** p<0.05, * p<0.1)

Table 2.13: Effect of the program on Enrolment

Enrolment	(1)	(2)	(3)
treatment_post	0.179***	0.117***	0.089***
	(0.021)	(0.034)	(0.034)
treatment_post_female		0.118**	0.103**
		(0.047)	(0.047)
treatment_female		-0.101***	-0.102***
		(0.025)	(0.025)
post_female		0.052	0.066
		(0.042)	(0.041)
female	-0.095***	-0.057***	-0.060***
	(0.010)	(0.021)	(0.021)
Cohort Fixed effects	YES	YES	YES
Birth order effects	No	No	YES
Family fixed effects	YES	YES	YES
State specific time trends	YES	YES	YES
Constant	0.656***	0.659***	0.625***
	(0.045)	(0.043)	(0.059)
Outcome Mean (pre program)	0.742	0.742	0.742
Observations	13,085	13,085	13,085
R-squared	0.142	0.152	0.168
Number of households	3,747	3,747	3,747

Notes: We use the fifty-second and the sixty-fourth round of NSS to test whether the program had any effect on enrolment using the DID methodology. The cohorts under consideration are those born between 1971 and 1993. The dependent variable is an indicator picking up whether the child was ever enrolled in primary school. Treatment is an indicator for the treated districts. Post is an indicator for the younger siblings in the family exposed to the program. In column 2, we allow for the possibility of heterogeneous treatment effects by gender. In column 3, we allow for birth order effects by including an indicator for the second child, third child, etc. The excluded category is the first child. Outcome mean reports the mean of the outcome variable in the pre-program period. The standard errors are clustered at the district level (*** p<0.01, ** p<0.05, * p<0.1)

Table 2.14: Placebo results

	Stipulated entry age		Ever Enrolled	
	(1)	(2)	(3)	(4)
treatment_post	0.024	0.021	0.016	0.001
	(0.016)	(0.027)	(0.013)	(0.018)
treatment_post_female		0.009		0.039
		(0.036)		(0.032)
treatment_female		-0.012		-0.029
		(0.041)		(0.038)
post_female		0.044		0.026
		(0.035)		(0.031)
female	-0.182***	-0.063***	-0.241***	-0.065***
	(0.009)	(0.018)	(0.011)	(0.017)
Cohort fixed effects	Yes	Yes	Yes	Yes
Family fixed effects	Yes	Yes	Yes	Yes
Birth order fixed effects	No	Yes	No	Yes
State specific time trends	Yes	Yes	Yes	Yes
Constant	0.462***	0.318***	0.718***	0.583***
	(0.033)	(0.052)	(0.032)	(0.047)
Observations	9,654	9,654	9,654	9,654
R-squared	0.101	0.110	0.159	0.176
Number of households	2,115	2,115	2,115	2,115

Notes: We falsely assume that the program was implemented in 1990 in the districts where the program actually began in 1995 and 1996. Finally, we assume that this mock treatment was extended to the remaining districts in 1993. We use the combined sample of NSS 52 and 64 to test whether this placebo treatment affected entry at the stipulated age and ever being enrolled. The cohorts under consideration are those born between 1971 and 1987. Cohorts born after 1987 are excluded as they are exposed to the actual treatment. In column 2 and 4, we allow for the possibility of heterogeneous treatment effects by interacting the treatment_post variable with a female dummy. We also allow for birth order effects in Column 2 and 4. The standard errors are clustered at the district level (*** p<0.01, ** p<0.05, * p<0.1).

Table 2.15: Maximum Likelihood estimates of Time to School entry - Marginal effects

School entry	(1)	(2)	(3)	(4)	(5)
Baseline Hazard:					
Legal entry age + 1	-0.171***	-0.171***	-0.169***	-0.169***	-0.166***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.008)
Legal entry age + 2	-0.216***	-0.214***	-0.213***	-0.213***	-0.213***
	(0.009)	(0.009)	(0.009)	(0.008)	(0.010)
Legal entry age + 3	-0.255***	-0.254***	-0.253***	-0.253***	-0.260***
	(0.010)	(0.010)	(0.010)	(0.009)	(0.011)
Legal entry age + 4	-0.262***	-0.260***	-0.260***	-0.259***	-0.253***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.011)
Legal entry age + 5	-0.320***	-0.318***	-0.318***	-0.318***	-0.323***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.015)
Treatment:					
treated_districts	-0.130***	-0.119***	-0.119***	-0.088***	-0.071**
	(0.023)	(0.023)	(0.023)	(0.031)	(0.030)
program_eligible	0.062***	0.041***	0.035***	0.036***	
	(0.009)	(0.012)	(0.013)	(0.013)	
female	-0.098***	-0.098***	-0.099***	-0.054	-0.058*
	(0.008)	(0.008)	(0.008)	(0.033)	(0.033)
program_eligible_female				0.046	0.046
				(0.033)	(0.033)
program_eligible_age1					0.052***
					(0.016)
program_eligible_age2					0.043***
					(0.014)
program_eligible_age3					0.031***
					(0.010)
program_eligible_age4					0.015***
					(0.005)
program_eligible_age5					0.012***
					(0.004)
Background Characteristics					
muslim	-0.099***	-0.097***	-0.099***	-0.099***	-0.094***
	(0.008)	(0.008)	(0.009)	(0.009)	(0.009)
ST	-0.082***	-0.082***	-0.079***	-0.079***	-0.100***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
SC	-0.096***	-0.096***	-0.095***	-0.095***	-0.089***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
OBC	-0.093***	-0.093***	-0.092***	-0.092***	-0.083***
	(0.009)	(0.009)	(0.010)	(0.010)	(0.010)

Note: Table continued

Table 2.15 continued: Maximum Likelihood estimates of Time to School entry – Marginal effects

School entry	(1)	(2)	(3)	(4)	(5)
household_size	0.016*	0.013	0.011	0.011	0.014
	(0.009)	(0.010)	(0.010)	(0.010)	(0.010)
father_primary schooling	0.101***	0.102***	0.102***	0.102***	0.100***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
father_secondary schooling	0.234***	0.234***	0.233***	0.233***	0.236***
	(0.018)	(0.018)	(0.019)	(0.019)	(0.019)
mother_primary schooling	0.166***	0.166***	0.165***	0.165***	0.167***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.013)
mother_secondary schooling	0.246***	0.246***	0.245***	0.245***	0.232***
	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)
Distance to Primary school	-0.068***	-0.065***	-0.063***	-0.063***	-0.052***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Agricultural household	-0.069***	-0.070***	-0.070***	-0.070***	-0.077***
	(0.020)	(0.020)	(0.020)	(0.020)	(0.019)
Birth order effects	No	Yes	Yes	Yes	Yes
State fixed effects	No	No	Yes	Yes	Yes
Standard deviation of Unobserved heterogeneity	0.005	0.007	0.005	0.005	0.005
	(0.021)	(0.020)	(0.022)	(0.022)	(0.026)
Observations	17,954	17,954	17,954	17,954	17,954
Number of children	7,877	7,877	7,877	7,877	7,877
Log likelihood	-7510.042	-7500.066	-7480.115	-7479.158	-7430.019

Notes: The above table presents the Maximum likelihood estimates of the hazard function. The dependent variable is a binary indicator picking up whether the child entered school. Legal entry age + 1 is an indicator for the age following the legal entry age and so on. The omitted category is the stipulated school entry age. Treated districts are an indicator for the districts that implemented the program earlier in 1995 and 1996. Program eligible is a time varying binary variable picking up the age at which the child is eligible for the program (see Table 2.11). Normalised age 1 refers to the legal entry age and normalised age 2 is an indicator for the age following the legal entry age and so on. Household size is a binary variable capturing whether the household is a nuclear family (consisting of 5 members or less). Mother_primary schooling and mother_secondary schooling indicate whether the child's mother has completed primary school or secondary school or higher, respectively. Distance to primary school is a binary variable indicating whether the child resides more than 2 kilometres from the nearest primary school. Column 2 onwards includes birth order effects, while column 3 onwards includes states dummies. Column 4 allows for heterogeneous effects by gender by including the interaction between the program eligible and female dummies. Column 5 also includes the interaction between the program eligible variable and the normalised age indicators. Unobserved heterogeneity assumed to be normally distributed. Robust standard errors are in parenthesis (*** p<0.01, ** p<0.05, * p<0.1).

Table 2.16: Illustration of the dependent variable and alternative Program variable

Child ID	Age of child	Age when child entered school	Dependent Variable	Dependent Variable (censored observations)	Program introduced when child was aged:		
					Case 1: 5 (legal entry age) or earlier	Case 2: 6 years old	Case 3: 7 years and above
1	5	Legal entry age	1	0	1	0	0
2	6	One year after the legal entry age	0	0	1	0	0
			1	0	1	0	0
3	7	2 years after the legal entry age	0	0	1	0	0
			0	0	1	0	0
			1	0	1	0	0
4	8	3 years after the legal entry age	0	0	1	0	0
			0	0	1	0	0
			0	0	1	0	0
			1	0	1	0	0
5	9	4 years after the legal entry age	0	0	1	0	0
			0	0	1	0	0
			0	0	1	0	0
			0	0	1	0	0
			1	0	1	0	0
6	10	5 years after the legal entry age	0	0	1	0	0
			0	0	1	0	0
			0	0	1	0	0
			0	0	1	0	0
			0	0	1	0	0
			1	0	1	0	0
7	11	6 years after the legal entry age	0	0	1	0	0
			0	0	1	0	0
			0	0	1	0	0
			0	0	1	0	0
			0	0	1	0	0
			0	0	1	0	0
			1	0	1	0	0

Notes: This table presents an alternative way in which the program variable was coded for the estimation of the discrete time duration model, compared to Table 2.11. This allows us to identify the marginal impact of the program by enabling us to look at whether children were more likely to enter school at the stipulated age, given that the program was introduced at the legal entry age for that child. In the above illustration, we assume that the legal entry age is 5. However, this can be generalised to the other states where the SSA is 6.

Table 2.17: Maximum Likelihood estimates of Time to School entry using alternate program variable - Marginal effects

School entry	(1)	(2)	(3)	(4)
Baseline Hazard:				
Legal entry age + 1	-0.169***	-0.169***	-0.167***	-0.167***
	(0.007)	(0.007)	(0.007)	(0.007)
Legal entry age + 2	-0.213***	-0.212***	-0.211***	-0.211***
	(0.008)	(0.008)	(0.008)	(0.008)
Legal entry age + 3	-0.253***	-0.253***	-0.252***	-0.251***
	(0.009)	(0.009)	(0.009)	(0.009)
Legal entry age + 4	-0.259***	-0.258***	-0.257***	-0.257***
	(0.010)	(0.010)	(0.010)	(0.010)
Legal entry age + 5	-0.317***	-0.317***	-0.316***	-0.316***
	(0.005)	(0.005)	(0.005)	(0.005)
Treatment:				
treated_districts	-0.107***	-0.105***	-0.095***	-0.064**
	(0.022)	(0.022)	(0.022)	(0.030)
program_eligible	0.069***	0.051***	0.044***	0.044***
	(0.009)	(0.013)	(0.014)	(0.014)
female	-0.098***	-0.097***	-0.097***	-0.051
	(0.008)	(0.008)	(0.008)	(0.033)
program_eligible_female				0.047
				(0.034)
Background Characteristics:				
muslim	-0.098***	-0.097***	-0.099***	-0.099***
	(0.008)	(0.008)	(0.009)	(0.009)
ST	-0.081***	-0.082***	-0.078***	-0.077***
	(0.010)	(0.010)	(0.010)	(0.010)
SC	-0.096***	-0.096***	-0.096***	-0.096***
	(0.010)	(0.010)	(0.010)	(0.010)
OBC	-0.093***	-0.094***	-0.092***	-0.092***
	(0.009)	(0.009)	(0.010)	(0.010)
household_size	0.016*	0.015	0.013	0.013
	(0.009)	(0.010)	(0.010)	(0.010)
father_primary schooling	0.102***	0.102***	0.102***	0.103***
	(0.012)	(0.012)	(0.012)	(0.012)
father_secondary schooling	0.234***	0.235***	0.236***	0.236***
	(0.018)	(0.019)	(0.019)	(0.019)
mother_primary schooling	0.166***	0.166***	0.165***	0.165***
	(0.012)	(0.012)	(0.012)	(0.012)
mother_secondary schooling	0.248***	0.247***	0.247***	0.247***
	(0.023)	(0.023)	(0.023)	(0.023)

Note: Table continued

Table 2.17 continued: Maximum Likelihood estimates of Time to School entry using alternate program variable - Marginal effects

School entry	(1)	(2)	(3)	(4)
Distance to Primary school	-0.064***	-0.063***	-0.078*	-0.078*
	(0.008)	(0.008)	(0.040)	(0.040)
Agricultural household	-0.069***	-0.069***	-0.083***	-0.083***
	(0.020)	(0.020)	(0.019)	(0.019)
Birth order effects	No	Yes	Yes	Yes
State fixed effects	No	No	Yes	Yes
Standard deviation of Unobserved heterogeneity	0.005	0.005	0.005	0.005
	(0.021)	(0.020)	(0.023)	(0.023)
Observations	17,954	17,954	17,954	17,954
Number of children	7,877	7,877	7,877	7,877
Log Likelihood	-7505.498	-7497.589	-7458.170	-7457.175

Notes: The above table presents the Maximum likelihood estimates of the hazard function. The dependent variable is a binary indicator picking up whether the child entered school. Legal entry age + 1 is an indicator for the age following the legal entry age and so on. The omitted category is age 1, or the stipulated school entry age. Treated districts are an indicator for the districts that implemented the program earlier in 1995 and 1996. Program eligible is a binary variable picking up whether the program was available at the legal entry age of that child (see Table 2.16). Household size is a binary variable capturing whether the household is a nuclear family (consists of 5 members or less). Mother_primary schooling and mother_secondary schooling indicate whether the child's mother has completed primary school or secondary school or higher, respectively. Distance to primary school is a binary variable indicating whether the child resides more than 2 kilometres from the nearest primary school. Column 2 onwards includes birth order effects, while column 3 onwards includes states dummies. Column 4 allows for heterogeneous effects by gender by including the interaction between the program eligible and female dummies. Unobserved heterogeneity assumed to be normally distributed. Robust standard errors are in parenthesis (*** p<0.01, ** p<0.05, * p<0.1).

Table 2.18: Maximum Likelihood estimates of time to school entry using Complementary log-log specification – Marginal effects

	Program available at any time during primary school		Program available at the Stipulated school starting age	
School entry	(1)	(2)	(3)	(4)
Baseline Hazard:				
Legal entry age + 1	-0.124***	-0.124***	-0.122***	-0.122***
	(0.006)	(0.006)	(0.006)	(0.006)
Legal entry age + 2	-0.172***	-0.171***	-0.169***	-0.169***
	(0.008)	(0.008)	(0.008)	(0.008)
Legal entry age + 3	-0.216***	-0.216***	-0.214***	-0.214***
	(0.010)	(0.009)	(0.009)	(0.009)
Legal entry age + 4	-0.224***	-0.224***	-0.222***	-0.222***
	(0.010)	(0.010)	(0.010)	(0.010)
Legal entry age + 5	-0.287***	-0.287***	-0.285***	-0.285***
	(0.005)	(0.005)	(0.005)	(0.005)
Treatment:				
treated_districts	-0.063***	-0.038**	-0.046***	-0.043**
	(0.014)	(0.017)	(0.013)	(0.020)
Program eligible	0.031***	0.031***	0.041***	0.041***
	(0.008)	(0.008)	(0.009)	(0.009)
female	-0.060***	-0.018	-0.059***	-0.017
	(0.005)	(0.019)	(0.005)	(0.019)
program_eligible_female		0.044**		0.022
		(0.020)		(0.016)
Birth order effects	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes
Background characteristics	Yes	Yes	Yes	Yes
Standard deviation of Unobserved heterogeneity	0.008	0.006	0.048	0.012
	(0.040)	(0.022)	(0.123)	(0.034)
Observations	17,954	17,954	17,954	17,954
Number of children	7877	7877	7877	7877
Log Likelihood	-7538.475	-7535.997	-7517.714	-7515.294

Notes: The above table presents the Maximum Likelihood estimates of the hazard function using the complementary log-log specification. The dependent variable is a binary indicator picking up when the child entered school. Treated districts are an indicator for the districts that implemented the program earlier in 1995 and 1996. In columns 1 and 2, the program variable is a time varying binary variable picking up the age at which the child is eligible for the program (see Table 2.11). In columns 3 and 4, the Program eligible variable is a binary variable picking up whether the program was available at the legal entry age of that child (see Table 2.16). The background characteristics includes: Muslim, SC, ST, OBC, household size, household's main economic activity, father and mother's education, distance to primary school. Robust standard errors are in parenthesis (*** p<0.01, ** p<0.05, * p<0.1).

Table 2.19: Robustness Checks – Maximum Likelihood estimates of time to school entry (Household level random effects)

	Program introduced at any time during primary school		Program introduced at the Stipulated school starting age	
School entry	(1)	(2)	(3)	(4)
Baseline Hazard:				
Legal entry age + 1	-0.131***	-0.131***	-0.123***	-0.123***
	(0.012)	(0.012)	(0.012)	(0.012)
Legal entry age + 2	-0.222***	-0.222***	-0.212***	-0.211***
	(0.013)	(0.013)	(0.013)	(0.013)
Legal entry age + 3	-0.338***	-0.338***	-0.331***	-0.330***
	(0.015)	(0.015)	(0.015)	(0.015)
Legal entry age + 4	-0.357***	-0.357***	-0.348***	-0.348***
	(0.015)	(0.015)	(0.015)	(0.015)
Legal entry age + 5	-0.458***	-0.457***	-0.453***	-0.453***
	(0.014)	(0.014)	(0.014)	(0.014)
Treatment:				
treated_districts	-0.255***	-0.217***	-0.202***	-0.167**
	(0.057)	(0.070)	(0.059)	(0.072)
program_eligible	0.102***	0.102***	0.142***	0.142***
	(0.022)	(0.022)	(0.025)	(0.025)
female	-0.230***	-0.170***	-0.224***	-0.171***
	(0.015)	(0.062)	(0.015)	(0.063)
program_eligible_female		0.062		0.056
		(0.063)		(0.064)
Birth order effects	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes
Background characteristics	Yes	Yes	Yes	Yes
Standard deviation of Unobserved heterogeneity	0.490	0.490	0.489	0.489
	(0.019)	(0.019)	(0.019)	(0.019)
Observations	17,954	17,954	17,954	17,954
Number of households	2,222	2,222	2,222	2,222
Log Likelihood	-6926.050	-6925.570	-6909.160	-6908.774

Notes: The above table presents the Maximum likelihood estimates of the hazard function. The dependent variable is a binary indicator picking up whether the child entered school. We allow for random effects at the household level. Treated districts are an indicator for the districts that implemented the program earlier in 1995 and 1996. In columns 1 and 2, the program variable is a time varying binary variable picking up the age at which the child is eligible for the program (see Table 2.11). In columns 3 and 4, the Program eligible variable is a binary variable picking up whether the program was available at the legal entry age of that child (see Table 2.16). The background characteristics includes: Muslim, SC, ST, OBC, household size, household's main economic activity, father and mother's education, distance to primary school. Unobserved heterogeneity assumed to be normally distributed. Robust standard errors are in parenthesis (*** p<0.01, ** p<0.05, * p<0.1).

2.10 Appendix

Table 2.A1: The impact of the program on starting school at the stipulated age (Robustness checks)

	(1)	(2)	(3)
Start school at the stipulated age			
treatment_post	0.102**	0.088**	0.079*
	(0.043)	(0.044)	(0.045)
treatment_post_female		0.025	0.017
		(0.083)	(0.081)
treatment_female		-0.026	-0.030
		(0.025)	(0.025)
post_female		0.154**	0.170**
		(0.078)	(0.076)
female	-0.045***	-0.041*	-0.047**
	(0.010)	(0.022)	(0.023)
Household fixed effects	Yes	Yes	Yes
Cohort fixed effects	Yes	Yes	Yes
Birth order effects	No	No	Yes
District specific time trends	Yes	Yes	Yes
Constant	0.609***	0.607***	0.622***
	(0.049)	(0.049)	(0.070)
Observations	13,085	13,085	13,085
R-squared	0.104	0.109	0.120
Number of households	3,747	3,747	3,747

Notes: We use NSS 52 and NSS 64 to test whether the program had any effect on starting primary school at the stipulated age using the DID methodology. The cohorts under consideration are those born between 1971 and 1993. The dependent variable is an indicator picking up whether the child started school at the stipulated age. Treatment is an indicator for the treated districts. Post is an indicator for the younger siblings in the family. In column 2, we allow for the possibility of heterogeneous treatment effects by gender. In column 3, we allow for birth order effects by including an indicator for the second child, third child, etc. The excluded category is the first child. As a robustness check, we include district-specific time trends in the specification. The standard errors are clustered at the district level (*** p<0.01, ** p<0.05, * p<0.1).

Table 2.A2: The impact of the program on Enrolment (Robustness Checks)

Enrolment	(1)	(2)	(3)
treatment_post	0.173***	0.120***	0.109***
	(0.022)	(0.029)	(0.030)
treatment_post_female		0.114***	0.118***
		(0.043)	(0.044)
treatment_female		-0.078***	-0.083***
		(0.021)	(0.021)
post_female		0.084**	0.094**
		(0.037)	(0.037)
female	-0.095***	-0.058***	-0.072***
	(0.010)	(0.017)	(0.018)
Household fixed effects	Yes	Yes	Yes
Cohort fixed effects	Yes	Yes	Yes
Birth order effects	No	No	Yes
District specific time trends	Yes	Yes	Yes
Constant	0.708***	0.709***	0.707***
	(0.033)	(0.033)	(0.059)
Observations	13,085	13,085	13,085
R-squared	0.125	0.135	0.145
Number of households	3,747	3,747	3,747

Notes: We use the fifty-second and the sixty-fourth round of NSS to test whether the program had any effect on enrolment using the DID methodology. The cohorts under consideration are those born between 1971 and 1993. The dependent variable is an indicator picking up whether the child was ever enrolled in primary school. Treatment is an indicator for the treated districts. Post is an indicator for the younger siblings in the family. In column 2, we allow for the possibility of heterogeneous treatment effects by gender. In column 3, we allow for birth order effects by including an indicator for the second child, third child, etc. The excluded category is the first child. As a robustness check, we include district-specific time trends in the specification. The standard errors are clustered at the district level (*** p<0.01, ** p<0.05, * p<0.1).

Table 2.A3: The impact of the program on starting school at the stipulated age (Robustness Checks)

	(1)	(2)	(3)
Start school at the stipulated age			
treatment_post	0.097**	0.088*	0.079*
	(0.043)	(0.051)	(0.045)
treatment_post_female		0.014	0.017
		(0.071)	(0.070)
treatment_female		-0.025	-0.030
		(0.025)	(0.024)
post_female		0.166**	0.170***
		(0.064)	(0.064)
female	-0.045***	-0.041*	-0.047**
	(0.009)	(0.022)	(0.023)
Household fixed effects	Yes	Yes	Yes
Cohort fixed effects	Yes	Yes	Yes
Birth order effects	No	No	Yes
State specific time trends	Yes	Yes	Yes
Constant	0.603***	0.604***	0.622***
	(0.059)	(0.059)	(0.072)
Observations	13,085	13,085	13,085
R-squared	0.106	0.111	0.120
Number of households	3,747	3,747	3,747

Notes: We use NSS 52 and NSS 64 to test whether the program had any effect on starting primary school at the stipulated age using the DID methodology. The cohorts under consideration are those born between 1971 and 1993. The dependent variable is an indicator picking up whether the child started school at the stipulated age. Treatment is an indicator for the treated districts. Post is an indicator for the younger siblings in the family. In column 2, we allow for the possibility of heterogeneous treatment effects by gender. In column 3, we allow for birth order effects by including an indicator for the second child, third child, etc. The excluded category is the first child. As a robustness check, we cluster standard errors at the household level (*** p<0.01, ** p<0.05, * p<0.1).

Table 2.A4: The impact of the program on Enrolment (Robustness checks)

	(1)	(2)	(3)
Enrolment			
treatment_post	0.176***	0.121***	0.107***
	(0.023)	(0.030)	(0.030)
treatment_post_female		0.113***	0.119***
		(0.043)	(0.043)
treatment_female		-0.075***	-0.080***
		(0.021)	(0.021)
post_female		0.084**	0.095**
		(0.036)	(0.037)
female	-0.094***	-0.060***	-0.074***
	(0.010)	(0.017)	(0.018)
Household fixed effects	Yes	Yes	Yes
Cohort fixed effects	Yes	Yes	Yes
Birth order effects	No	No	Yes
State specific time trends	Yes	Yes	Yes
Constant	0.722***	0.739***	0.719***
	(0.052)	(0.051)	(0.078)
Observations	13,085	13,085	13,085
R-squared	0.131	0.140	0.150
Number of households	3,747	3,747	3,747

Notes: We use NSS 52 and NSS 64 to test whether the program had any effect on starting primary school at the stipulated age using the DID methodology. The cohorts under consideration are those born between 1971 and 1993. The dependent variable is an indicator picking up whether the child started school at the stipulated age. Treatment is an indicator for the treated districts. Post is an indicator for the younger siblings in the family. In column 2, we allow for the possibility of heterogeneous treatment effects by gender. In column 3, we allow for birth order effects by including an indicator for the second child, third child, etc. The excluded category is the first child. As a robustness check, we cluster standard errors at the household level (*** p<0.01, ** p<0.05, * p<0.1).

Table 2.A5: Maximum Likelihood estimates of time to school entry (odds ratio)

School entry	(1)	(2)	(3)	(4)	(5)
Baseline Hazard:					
Legal entry age + 1	0.249***	0.252***	0.255***	0.255***	0.258***
	(0.013)	(0.013)	(0.013)	(0.013)	(0.017)
Legal entry age + 2	0.114***	0.116***	0.118***	0.118***	0.115***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.011)
Legal entry age + 3	0.036***	0.037***	0.037***	0.037***	0.028***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)
Legal entry age + 4	0.026***	0.027***	0.028***	0.028***	0.032***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.006)
Legal entry age + 5	0.002***	0.002***	0.002***	0.002***	0.001***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Treatment:					
treated_districts	0.512***	0.538***	0.537***	0.623***	0.675***
	(0.053)	(0.056)	(0.057)	(0.094)	(0.101)
program_eligible	1.444***	1.274***	1.237***	1.240***	
	(0.071)	(0.086)	(0.094)	(0.094)	
female	0.559***	0.557***	0.553***	0.723	0.704*
	(0.024)	(0.024)	(0.024)	(0.143)	(0.139)
program_eligible_female				1.005	1.005
				(0.652)	(0.652)
program_eligible_age1					1.376***
					(0.104)
program_eligible_age2					1.257***
					(0.140)
program_eligible_age3					1.234***
					(0.204)
program_eligible_age4					1.189***
					(0.535)
program_eligible_age5					1.008***
					(0.278)
Background Characteristics					
muslim	0.506***	0.512***	0.506***	0.506***	0.522***
	(0.031)	(0.032)	(0.032)	(0.032)	(0.033)
ST	0.578***	0.576***	0.588***	0.588***	0.501***
	(0.040)	(0.040)	(0.042)	(0.042)	(0.036)
SC	0.519***	0.518***	0.520***	0.521***	0.545***
	(0.037)	(0.037)	(0.037)	(0.037)	(0.039)
OBC	0.558***	0.558***	0.563***	0.562***	0.592***
	(0.033)	(0.033)	(0.033)	(0.033)	(0.035)

Note: Table continued

Table 2.A5 continued: Maximum Likelihood estimates of time to school entry (odds ratio)

School entry	(1)	(2)	(3)	(4)	(5)
household_size	1.099*	1.083	1.067	1.068	1.089
	(0.060)	(0.062)	(0.062)	(0.062)	(0.063)
father_primary schooling	1.731***	1.734***	1.739***	1.742***	1.725***
	(0.102)	(0.102)	(0.103)	(0.103)	(0.102)
father_secondary schooling	3.104***	3.112***	3.099***	3.100***	3.148***
	(0.234)	(0.235)	(0.234)	(0.234)	(0.239)
mother_primary schooling	2.364***	2.367***	2.359***	2.361***	2.394***
	(0.129)	(0.129)	(0.129)	(0.129)	(0.132)
mother_secondary schooling	3.243***	3.238***	3.224***	3.229***	3.079***
	(0.300)	(0.300)	(0.301)	(0.301)	(0.288)
Distance to primary school	0.662***	0.673***	0.684***	0.684***	0.728***
	(0.032)	(0.033)	(0.034)	(0.034)	(0.036)
Agricultural household	0.616***	0.613***	0.613***	0.613***	0.573***
	(0.100)	(0.100)	(0.100)	(0.100)	(0.097)
Birth order effects	No	Yes	Yes	Yes	Yes
State fixed effects	No	No	Yes	Yes	Yes
Standard deviation of Unobserved heterogeneity	0.005	0.007	0.005	0.005	0.005
	(0.021)	(0.020)	(0.022)	(0.022)	(0.026)
Constant	5.314***	4.508***	4.845***	4.189***	3.964***
	(0.608)	(0.610)	(0.706)	(0.747)	(0.701)
Observations	17,954	17,954	17,954	17,954	17,954
Number of children	7,877	7,877	7,877	7,877	7,877
Log likelihood	-7510.042	-7500.066	-7480.115	-7479.158	-7430.019

Notes: This table presents the corresponding odds ratios to Table 2.15, reporting the Maximum likelihood estimates of the hazard function. The dependent variable is a binary indicator picking up whether the child entered school. Normalised age 2 is an indicator for the age following the legal entry age and so on. The omitted category is age 1, or the stipulated school entry age. Treated districts are an indicator for the districts that implemented the program earlier in 1995 and 1996. Program eligible is a time varying binary variable picking up the age at which the child is eligible for the program (see Table 2.11). Column 2 onwards includes birth order effects, while column 3 onwards includes states dummies. Column 4 allows for heterogeneous effects by gender by including the interaction between the program eligible and female dummies. Column 5 also includes the interaction between the program eligible variable and the normalised age indicators. Unobserved heterogeneity assumed to be normally distributed. Robust standard errors are in parenthesis (*** p<0.01, ** p<0.05, * p<0.1).

Table 2.A6: Maximum Likelihood estimates of Time to school entry using alternate program variable (odds ratio)

School entry	(1)	(2)	(3)	(4)
Baseline Hazard:				
Legal entry age + 1	0.257***	0.257***	0.261***	0.261***
	(0.013)	(0.013)	(0.013)	(0.013)
Legal entry age + 2	0.120***	0.121***	0.122***	0.122***
	(0.009)	(0.009)	(0.009)	(0.009)
Legal entry age + 3	0.039***	0.039***	0.039***	0.039***
	(0.005)	(0.005)	(0.005)	(0.005)
Legal entry age + 4	0.029***	0.029***	0.029***	0.029***
	(0.004)	(0.004)	(0.004)	(0.004)
Legal entry age + 5	0.002***	0.002***	0.002***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)
Treatment:				
treated_districts	0.568***	0.573***	0.601***	0.703**
	(0.057)	(0.058)	(0.063)	(0.106)
program_eligible	1.490***	1.351***	1.299***	1.299***
	(0.073)	(0.096)	(0.101)	(0.102)
female	0.559***	0.559***	0.560***	0.736
	(0.023)	(0.024)	(0.025)	(0.146)
program_eligible_female				1.002
				(0.152)
Background Characteristics				
muslim	0.508***	0.512***	0.504***	0.504***
	(0.032)	(0.032)	(0.032)	(0.032)
ST	0.581***	0.578***	0.596***	0.596***
	(0.040)	(0.040)	(0.042)	(0.042)
SC	0.520***	0.518***	0.517***	0.518***
	(0.037)	(0.037)	(0.037)	(0.037)
OBC	0.557***	0.556***	0.561***	0.561***
	(0.033)	(0.033)	(0.033)	(0.033)
household_size	1.101*	1.093	1.082	1.083
	(0.060)	(0.062)	(0.063)	(0.063)
father_primary schooling	1.735***	1.738***	1.743***	1.746***
	(0.102)	(0.102)	(0.103)	(0.104)
father_secondary schooling	3.114***	3.118***	3.146***	3.147***
	(0.235)	(0.235)	(0.238)	(0.239)
mother_primary schooling	2.368***	2.367***	2.362***	2.363***
	(0.129)	(0.129)	(0.130)	(0.130)
mother_secondary schooling	3.263***	3.257***	3.256***	3.260***
	(0.302)	(0.302)	(0.305)	(0.305)

Note: Table continued

Table 2.A6 continued: Maximum Likelihood estimates of time to school entry using alternate program variable (odds ratio)

School entry	(1)	(2)	(3)	(4)
Distance to primary school	0.677***	0.682***	0.609*	0.605*
	(0.033)	(0.033)	(0.395)	(0.394)
Agricultural household	0.619***	0.615***	0.548***	0.548***
	(0.101)	(0.100)	(0.091)	(0.091)
Birth order effects	No	Yes	Yes	Yes
State fixed effects	No	No	Yes	Yes
Standard deviation of Unobserved heterogeneity	0.005	0.005	0.005	0.005
	(0.021)	(0.020)	(0.023)	(0.023)
Constant	4.654***	4.155***	1.451	1.249
	(0.540)	(0.556)	(0.438)	(0.399)
Observations	17,954	17,954	17,954	17,954
Number of children	7,877	7,877	7,877	7,877
Log Likelihood	-7505.498	-7497.589	-7458.170	-7457.175

Notes: This table presents the corresponding Odds ratio to Table 2.17. We report the Maximum likelihood estimates of the hazard function. The dependent variable is a binary indicator picking up whether the child entered school. Normalised age 2 is an indicator for the age following the legal entry age and so on. The omitted category is age 1, or the stipulated school entry age. Treated districts are an indicator for the districts that implemented the program earlier in 1995 and 1996. Program eligible is a binary variable picking up whether the program was available at the legal entry age of that child (see Table 2.16). Household size is a binary variable capturing whether the household is a nuclear family (consists of 5 members or less). Mother_primary schooling and mother_secondary schooling indicate whether the child's mother has completed primary school or secondary school or higher, respectively. Distance to primary school is a binary variable indicating whether the child resides more than 2 kilometres from the nearest primary school. Column 2 onwards includes birth order effects, while column 3 onwards includes states dummies. Column 4 allows for heterogeneous effects by gender by including the interaction between the program eligible and female dummies. Unobserved heterogeneity assumed to be normally distributed. Robust standard errors are in parenthesis (*** p<0.01, ** p<0.05, * p<0.1).

Chapter 3: The Impact of a School Nutrition program in India on Primary School Completion

Abstract

The objective of this chapter is to study the effect of the introduction of the National Program of Nutritional support to Primary education in India on primary school completion. In particular, we are interested in studying whether the program led to an increase in the probability of completing lower primary school (Grade 5) and upper primary school (Grade 7).

Distinct from Chapter 2, this chapter uses data from the District Level Household survey (DLHS), to estimate the impact of the distribution of food grains on primary school completion. The DLHS is a large household survey that is representative at the district level, which is useful since the treatment is administered at the district level. These surveys are suitable for the analysis in question as they explicitly contain information on educational attainment for each member of the household. On the other hand, the National sample survey (NSS), which was used in Chapter 2, only contains information on individuals aged between 5 and 24 at the time of the survey. As such, we cannot use the NSS to look at the effect of the program on primary and upper primary school completion as those aged between 5 and 11 are still in primary school and we do not observe whether they have completed it or not. The DLHS overcomes this problem by including information on the highest grade completed for each household member.[30]

Similar to Chapter 2, the identification strategy relies on exploiting the within family variation in the exposure of the program, in addition to the district level variation in the implementation of the policy. By employing a difference-in-differences estimation strategy, we find positive and significant effects of the program on primary school completion, with differential program effects by gender and by the number of years of exposure to the program. Additionally, we attempt to identify whether the program generated any spillover effects between siblings within the household. In particular, we estimate whether the program exposure by younger siblings of primary school age in the family affected the educational outcomes of older siblings. We do not find any evidence of spillover effects.

[30] A drawback of the DLHS is that it does not contain information on school starting age and so, we do not use it in Chapter 2.

3.1 Introduction:

Levels of educational attainment remain extremely low in many developing countries, despite substantial evidence that both the private and social returns to education are high (Hanushek, 1986; Schultz, 1988). In order to address this, the United Nations Millennium Development goals were established with the primary goal of alleviating poverty through the promotion of education, health and gender equality. In particular, the second millennium development goal sought to achieve Universal Primary education, and endeavoured to, "ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling" (United Nations report, 2010).

Thus, while enrolment in primary schools are a necessary condition to achieve the goal of universal primary education, completion is an equally important factor that allows students to reap the benefits of education. Free school meals and take home rations are attractive policy measures adopted by many developing countries to realize the goal of universal enrolment in primary schools. These programs lead to greater investments in education in low-income settings, primarily by subsidizing schooling costs and increasing the marginal benefits of attending school. Vermeersch and Kremer (2004) remark that school meals could also potentially improve educational attainment through two channels: First, school meals improve the nutritional status of the students. Second, this improved nutrition leads to better educational achievement as it improves the students' attention and concentration, reduces absenteeism and alleviates classroom hunger.

Further, school feeding programs may be potent enough to increase primary school completion rates by reducing drop-out rates, through improved nutrition and effective learning (Bundy et al., 2009). By raising educational attainment, these programs have the potential to improve future welfare through higher earnings in adulthood, better labour market outcomes and improved health for current and future generations (Adelman et al., 2008).

As such, given the channels through which school-feeding programs affects schooling outcomes, it proves worthwhile to investigate whether the National Program of Nutritional support to Primary education had an impact on educational attainment. This would be particularly relevant to policy-makers in terms of formulating future policies and would serve as a crucial component of policy evaluation in the Indian context. Moreover, there is very limited evidence on the effectiveness of these programs in increasing primary school completion rates, as discussed in Chapter 1.

Thus, the focus of this chapter is to empirically estimate the impact of a school feeding program in India, on primary school completion. As described earlier in Chapter 2, the Government of India launched the National Program of Nutritional support to Primary education in 1995. The policy was initially being administered by providing food rations to students on a monthly basis. More specifically, each student in a Government school received three kilograms of food grains per month, conditional on enrolment and a minimum of 80% monthly attendance. The program was implemented in a phased manner across districts.

We explore the impact of the take home rations program on lower and upper primary school completion rates by drawing on two large and representative household surveys: the second and the third round of the District Level Household surveys.[31] These data sets have in turn been combined with data on the timing of implementation of the program at the district level provided by the Ministry of Human resource development and the Ministry of Rural Development, Government of India.

We examine the impact of the take home rations program using a difference-in-differences technique. The identification strategy relies on the fact that the exposure to the program varied by district as well as by year of birth. The latter exploits the difference in exposure to the program between siblings in the household, induced by the timing of the program. Thus, this approach intends to compare younger eligible siblings, as they are of

[31] Lower primary school refers to Grades 1 to 5, while Upper Primary School refers to Grades 6-7.

primary school age at the time of introduction of the program, with older siblings who are past primary school age and are therefore unexposed, between the districts that started the program earlier (treated districts) to districts that implemented it later on (control districts).

We find evidence that the program increased the likelihood of completion of primary schooling. In particular, following the program introduction, those with program exposure in the treated districts experienced a 2.8 percentage point increase in the probability of lower primary school completion relative to those with no exposure. In terms of upper primary school completion rates, those eligible in the treated districts were 1.8 percentage points more likely to complete Grade 7 relative to those with no exposure to the program. We also find heterogeneous treatment effects by gender, with the effects being larger for girls. Further, we also find evidence of differential treatment effects by the number of years of exposure to the program. Our findings indicate that the largest gains accrued to those with five years of exposure to the program relative to those with no exposure.

We further attempt to identify whether the program generated any spillover effects via the intra-household allocation of food rations between siblings in the household. More specifically, we estimate whether having an eligible sibling(s) in the household influences the secondary school enrolment decisions of older ineligible siblings, who are too old to benefit from the program. We find no evidence of spillover effects within the family.

This paper is organised as follows. In the next section, we present the research questions, followed by a description of the datasets used and the empirical strategy adopted. Lastly, we present the findings and discuss the implications of the results.

3.2 Research Questions

The objective of this chapter is to investigate whether the food rations provided as part of the National Program of Nutritional support to Primary education had an effect on lower and upper primary school completion.

We focus on primary school completion as the main outcomes of interest as they have important implications for human capital accumulation and future labour market outcomes, given that the returns to education are higher in developing countries (Psacharopoulos and Patrinos, 2004). Additionally, it serves as a crucial component of policy evaluation in the Indian context.

The effect of the program on primary school completion is not entirely apparent. On the one hand, given that the program beneficiaries were incentivised with food grains from Grades one to five, we should expect a reduction in drop out rates from primary school. Moreover, with improved nutrition and learning, we would expect to observe an increase in primary school completion. On the contrary, children may be attracted by the free food grains and may choose to remain in primary school through grade repetition (Alderman et al., 2012). Additionally, crowded classrooms generated by these programs in the short run may have an adverse effect on educational attainment by acting as a deterrent to effective learning and may even discourage children from staying in school, compelling them to dropout (Ahmed and Arends-Kuenning, 2006).

Apart from investigating the immediate effect of the program, this chapter also identifies the effect of the take home rations program on upper primary school (Grade 7) completion. Thus, we seek to test whether the program effects linger on, even after the program ended in Grade 5.[32] As indicated in Chapter 1, most studies in the research literature focus on the short-term effects of school feeding programs and as such, whether the program effects persist have not been rigorously evaluated.

[32] Only students in Lower Primary school (Grades 1-5), received food rations on a monthly basis. Students in Upper Primary school (Grades 6-7) were precluded from the program.

The effects of the program on upper primary school completion are also not entirely obvious. On one hand, the additional food intake in lower primary school may encourage progression into upper primary school. This would arise for those students whose marginal benefits from entering Grade 6 are higher than the marginal costs. Their family's socio economic status permits them to remain in school instead of being pressured into participating in the labour force. On the other hand, the students that enrol into upper primary school no longer receive food grains, and so, they maybe discouraged. This occurs, as the marginal costs of attending upper primary school are higher relative to lower primary school. Additionally, the opportunity cost of attending school may also be higher as these children are now older and as such the benefits from entering the labour force may be higher than remaining in school.

Further, this paper also seeks to identify heterogeneous program effects by gender, as the related literature highlights that girls may be more susceptible to school feeding programs than boys. Additionally, we test whether there were differential program effects by the number of years of exposure to the program, owing to the timing of program implementation.

Finally, we attempt to identify educational spillover effects between siblings within the household, as a result of the program. That is, we estimate whether eligible siblings in the family have a positive influence on the schooling outcomes of ineligible siblings in the family, who are too old to benefit from the program. In particular, we test whether having an eligible sibling(s) in the household influences the secondary school enrolment of older ineligible siblings.

Thus, this paper intends to contribute to the growing research literature that assesses the impact of various educational interventions on schooling outcomes. In light of the scarce evidence in the related literature, on the impact of school feeding programs on primary school completion, this paper proposes to address this gap. Further, on account of the scarcity in the existing literature regarding the evaluation of the take home rations program and the estimation of externalities generated by school feeding programs, this paper seeks to address this gap, at least in the Indian context. This may be of particular importance from a public policy standpoint.

3.3 Data

The data for this paper comes from two large and representative household surveys: the second and the third round of the District Level Household survey (DLHS). These are described in more detail below.

The second and the third round of DLHS was commissioned by the Ministry of Health and Family Welfare, Government of India to be conducted by the International Institute for Population sciences. These surveys are representative at the district level. The second round of DLHS was conducted between 2002 and 2004 and contains information on 620,107 households located in 593 districts across India. All states and union territories were included in DLHS 2. Similarly, the third round was conducted between 2007 and 2008 and surveyed 720,320 households residing in 601 districts across the country. The third round of DLHS includes households located in all states and union territories in India, as per the 2001 Census with the exception of Nagaland.

These comprehensive cross-sectional household surveys are suitable for the analysis in question as they contain information on highest grade completed for each individual member of the household. We also observe each family member's age, gender, religion and caste group.

We complement these datasets with data on the timing of implementation of the National Program of Nutritional support to Primary education at the district level, that have been kindly provided by the Ministry of Rural Development and the Ministry of Human Resource Development, Government of India.

In the remainder of this section, we briefly discuss how we have constructed the analysis samples. First, for the purpose of analysing the impact of the take home rations program, we exclude 3 states, namely Gujarat, Tamil

Nadu and Kerala as these states had introduced the Midday meal scheme prior to 1995 in the 1980's and early 1990's. We also exclude all the Union territories for this current context.

Second, we only include the subsample of households residing in rural areas, as the proportion of private schools in rural areas is low (see Section 2.1). This is pertinent as the program was only implemented in Public schools across the country. Third, we focus on individuals born between 1970 and 1993. Firstly, this is done to ensure that they have completed their primary schooling at the time of the survey. Secondly, cohorts born post 1993 would have exposure to the cooked meals program. Since we do not want to confound the program effects from the take home rations and school meals, we restrict the sample to cohorts born up to 1993.

As described in more detail in the subsequent section, the methodology relies on identifying the program effect by comparing younger siblings of primary school age with older siblings who are past primary school age and therefore, have no exposure to the program within the household, between the treated and control districts. Consequently, since we are interested in comparing schooling outcomes between siblings within the household, the study excludes households that only have one child or no children. Additionally, households in the treated districts where all siblings are eligible for the program have also been dropped from the analysis as these households only contain primary school age children and do not include older siblings.

As such, the final sample from the two rounds of DLHS contains information on 292,395 siblings. This sample consists of cohorts born between 1970 and 1993. Of which, 51% are male, the majority are Hindus and the average number of siblings in the household are 3.61. Summary statistics for this sample is presented in Table 3.1. The proportion of individuals that completed Grade 5 is 0.66. The gender disparity in completion rates is quite large. The average upper primary school completion rate is 54.8%, for the cohorts under consideration. The corresponding figures for males and females are 59.6% and 48.8%, respectively.

Next, we present descriptive statistics for the pre-program period separately for the early program districts (treated districts) and late program districts (control districts) in Table 3.2. As discussed in the subsequent section, the estimation strategy relies on comparing siblings within households, between the treated and control districts.

From Table 3.2, we see that percentage of individuals who completed lower and upper primary school is significantly larger in the control districts, relative to the treated districts. We find negligible and statistically insignificant differences in the percentage of males between the treated and control districts. In terms of household characteristics, we find significant religious and caste-group differences between the treated and control districts. Parental education (completed years of schooling) is higher in the control districts relative to the treated districts, though the differences are not statistically significant. We also find statistically insignificant differences in average household size between the treated and control districts.

3.4 Methodology

3.4.1 Estimation strategy

Similar to the methodology adopted in Chapter 2, we employ a difference-in-differences estimation strategy to study the program effect on primary school completion (refer to section 2.5.1). We exploit both the district level variation in the program implementation, along with the intra-family variation in exposure to the program.

Essentially, this allows us to compare younger siblings who are of primary school age with older sibling who are past primary school age, between the early program districts and late program districts. As before, we define the treated districts or the early program districts as those districts that implemented the program in 1995 and 1996. Correspondingly, the control districts (late program) are the remaining districts where the program commenced in 1998.

We estimate the following empirical specification

$$y_{ijdy} = \beta + \delta(Treatment_d * Post_y) + \theta_y + \mu_j + \gamma_{sy} + \varepsilon_{ijdy} \qquad (1)$$

Where, y_{ijdy} refers to the outcome of interest for sibling i in household j in district d belonging to birth cohort y. The variable $Treatment_d$ is an indicator for the Treated districts d. As such, it captures the districts that implemented the program in 1995 and 1996.

Post is an indicator variable picking up whether sibling i is the youngest or the middle child in the household and is of primary school age at the time of implementation of the program. Treatment*Post is the interaction between the Treatment and the post variable. As such, it captures the eligible children in the treated district. Household fixed effects μ_j, cohort fixed effects θ_y and state specific time trends, γ_{sy} have also been included. Since the treatment was administered district-wise, we cluster standard errors at the district level.

3.4.2 Identifying Assumptions

The key assumption of the difference-in-differences strategy is that the trends in the outcome of interest are the same for the treated and control districts prior to the introduction of the program. In this section, we verify whether the underlying identification assumption of the estimation strategy adopted is satisfied.

We first plot the trends of the outcome variables for the different birth cohorts, separately for the treated and control districts in Figures 3.1 and 3.2. Cohorts born after 1990 in the treated districts would have full exposure to the program as they are 6 years or younger at the time of program introduction, while older cohorts would have partial or no exposure to the program. A child born in 1990 turns six in 1996 and so, this cohort would be eligible for the program at age 6 in the treated districts. By contrast, this same cohort would have no exposure to the program at age 6 in the control districts on account of the timing of the rollout of the scheme.

From figures 3.1 and 3.2, we indeed find parallel trends for lower and upper primary school completion rates between the treated and comparison districts. Figure 3.1 reveals an increase in lower primary school completion rates for the cohorts fully exposed to the program in the treated districts. Figure 3.2 does not reveal any clear pattern on the effect of the program on the cohorts exposed, indicating that the program had no effect on Grade 7 completion or perhaps had very small effects.

Next, in a regression framework, we explicitly test whether the underlying assumption is satisfied for each of the outcome variables by estimating the following specification:

$$y_{idy} = \alpha + \sum_{y=1971}^{1993}(Treatment_d * Cohort_y)\delta + \theta_y + \mu_d + \gamma_{sy} + \varepsilon_{idy} \qquad (2)$$

Where, y_{idy} denotes the outcome of interest for child i in district d, belonging to birth cohort y. Treatment is an indicator for the treated districts. Cohort is an indicator for each of the birth cohorts. We also include district fixed effects μ_d, cohort fixed effects θ_y and state-specfic time trends γ_{sy} in the specification.

The results from estimating equation 2 are presented in Table 3.3. We do not find any evidence of statistically significant differential pre-trends between the treated and control districts, for each of the outcome variables. This further validates the identification strategy adopted.

In the following section, we present the results of the program impacts on lower and upper primary school completion.

3.5 Results

3.5.1 Effect on Lower Primary school completion

In order to test whether completion rates increased as a result of the program, we use the combined sample of DLHS 2 and 3. We begin by estimating equation (1) where the dependent variable is an indicator equal to one if sibling i in household j completed lower primary school (grade 5) and is zero otherwise. The treatment variable is an indicator for the treatment group.

As described earlier, we ensure that each household in the treatment group consists of at least one older sibling that is more than 12 years of age at the time of program introduction and also contains at least one younger sibling of primary school age, exposed to the program.

The results from estimating equation (1) are provided in Table 3.4. We find evidence of positive effects of the program on lower primary school completion (Column 1). Notably, those exposed to the program in the treated districts experience a 2.8 percentage point increase in the likelihood of primary school completion relative to those with no exposure in the control districts.

Next, we allow for the possibility of heterogeneous program effects by gender in Column 2. We find that the benefits from the program accrue mainly to girls. Particularly, girls exposed to the program in the treated districts experience a 5.4 percentage point increase in the likelihood of primary school completion relative to those unexposed in the control districts. However, we find a negligible impact of the program for boys.

One concern is that we may very well be picking up birth order effects. That is, parents may treat the oldest child and the youngest child in the family very differently. In order to account for this, we include birth order fixed effects in Column 3. Once we control for birth order effects, we find positive program effects for both boys and girls. In particular, boys and girls exposed to the program are 1.8 percentage points and 3 percentage points more likely to complete primary school, respectively, compared to those with no program exposure.

In column 4, we allow for heterogeneous program effects by the number of years of exposure to the program, owing to the timing of implementation of the program. For instance, a child would only have one year of exposure to the program if the program were implemented when the child was in Grade

5. As such, a child would have at most five years of exposure to the program from Grades 1 to 5, depending on the year of program introduction. On the contrary, a child would have no exposure to the program if the child were too old to benefit from the program. We include indicators for the number of years of exposure to the program and interact it with the treated districts indicator.

The findings indicate that children in the treated districts with five years of exposure experienced a 3.6 percentage point increase in the probability of primary school completion, relative to those with no exposure to the program (Column 4). The program effects for those with one to four years of exposure in the treated districts are positive but statistically insignificant. This implies that the program was effective if the program was available from the start of primary school.

In conclusion, the findings indicate that the program proved effective, to some extent in increasing the probability of primary school completion, with the gains mainly accruing to girls and those with five years of exposure to the program.

3.5.2 Effect on Upper Primary school completion

In this section, we present the results of the program impact on upper primary school completion. The results are provided in Table 3.5. We find evidence that the take home rations program had a positive impact on upper primary school (grade 7) completion (Table 3.5, column 1). These results are extremely encouraging as they imply that the program effects lingered on even after the scheme ended in Grade 5.

Once we bifurcate the program effects by gender, we find that mainly girls benefitted from the program. More specifically, the program increased the likelihood of girls completing upper primary school by 1.6 percentage points. By contrast, the program effects for boys are positive but statistically insignificant. These results are presented in Column 3.

One plausible explanation for these negligible program effects for boys could be the increased marginal benefits from entering the labour force, since they are now older. At the same time, boys experienced higher marginal costs from entering upper primary school given that they did not receive any food grains. As such, one may speculate that boys and girls have different marginal benefits and costs from attending school and more so in the Indian context. Further, from chapter 2, we find that the enrolment effects of the program are larger for girls. So, this may translate into higher completion rates for girls.

In column 4, we allow for differential effects by the number of years of exposure to the program. Once again, we find that the program gains mainly accrue to those with five years of exposure. More specifically, those with five years of exposure in the treated districts enjoy a 1.2 percentage point increase in upper primary school completion, relative to those with no exposure to the program.

3.5.3 Completion of Primary School on time

Thus far, we have considered if children were more likely to ever complete primary school as a result of the program.

Next we check whether the children exposed to the program completed primary school on time. That is, whether they completed lower primary school (grade 5) by the recommended age or if they delayed completion through grade repetition in order to take advantage of the program. DLHS does not explicitly record grade repetition or grade retention. Therefore, we infer whether children repeated a grade by exploiting whether children completed primary school by the recommended age.[33]

[33] For instance a child born in 1990 turns 6 years old in 1996 and is exposed to the program if the child resided in a treated district. This child is observed at age 12 at the time of the survey in 2002. From the survey we have information as to whether the child has completed grade 5 or not at the time of the interview.

If children were less likely to complete primary school on time, as a result of the program, this would indicate two things. First, they deferred completion of primary school through grade repetition, in order to benefit from the free food grains. Second, they started school late, past the legal entry age (for instance at age 7) and as a result, they would complete primary school late.

In order to test this, we estimate the following specification

$$y_{idy} = \alpha + \delta(Treatment_d * Post_y) + \theta_y + \pi_d + \gamma_{sy} + \varepsilon_{idy} \quad (3)$$

The dependent variable is defined as a binary indicator picking up whether the child had completed lower primary school (Grade 5) by age 12.[34] Treatment is a binary variable denoting the treated districts where the program implementation took place in 1995 and 1996. Post is a binary indicator capturing the children who are of primary school age or younger at the time of program introduction. The interaction term Treatment*post captures the children who are exposed to the program in the treated districts. We include cohort fixed effects θ_y and district fixed effects π_d, in addition to state specific time trends γ_{sy}. As before, we cluster standard errors at the district level.

The results from estimating equation 3 are provided in Table 3.6. From columns 1 and 2, we find that program had a positive effect on completion of lower primary school by age 12, indicating on average, that the program encouraged children to complete primary school on time. More specifically, students exposed to the program were 1.7 percentage points more likely to complete lower primary school by age 12 (column 1). However, this might be underestimated by children who repeat grades or those that enter school late (past the legal enrolment age).

Next, we estimate the program impact on completion of primary school by age 14. The results are presented in columns 3 and 4. Thus, if the program effects of completion by age 14 are larger than the estimated program

[34] If the child had started school at the stipulated school starting age (age 6, for instance), then we would expect the child to complete primary school by age 12, if there were no grade repetition, retention or if the child did not dropout.

effects of completion by age 12, this would imply that the program encouraged older children (children who are past the legal enrolment age) to start school late and to complete school late. It would also provide suggestive evidence that the program provided children with an incentive to defer completing primary school so as to stay in school longer in order to benefit from the program.

From column 3, we see that the children exposed to the program in the treated districts were 4.2 percentage points more likely to complete school by age 14. Thus, we find that the program effects on primary school completion by age 14 are larger than the program effects on completion by age 12. Consistent with the results found in Chapter 2, this indicates that the program not only encouraged children to start school on time, but also encouraged older children (children who are past the legal enrolment age) to start school. Since the program encouraged older children (older than age 6) to start school following the stipulated entry age, these children are also less likely to complete primary school by age 12, but more likely to complete by age 14. Further, the results also provides suggestive evidence that children may have stayed in school longer (by completing primary school late), in order to benefit from the program.

3.6 Robustness Checks

3.6.1 Placebo treatment

An advantage of the estimation strategy adopted is that the implication of the identification assumption can be tested by exploiting the presence of multiple groups, formed by the successive cohorts not exposed to the program. We focus on a sample of siblings born between 1970 and 1987, as they do not have any direct exposure to the actual treatment at age 6 in 1995.

So, in this case, the identification assumption can be tested by falsely assuming that the program was introduced prior to the actual date of implementation. More specifically, we falsely assume that the program was implemented in 1990, five years before the actual treatment and test whether this placebo treatment has an impact on the outcomes of interest.

Consistent with the actual implementation of the program, we assume that this mock treatment was phased in sequentially. In the first phase, we assume that the program was launched in 1990 in the districts where the program actually began in 1995 and 1996. In the last phase, we assume that the program was extended to the remaining districts in 1993. We consider the former districts, as treated districts while the remaining districts are the control districts. In this case, cohorts born after 1984 in the treated districts were exposed to the placebo treatment at age 6 in 1990.

So, the identification assumption can be tested by estimating equation (1), for each of the outcome variables. As such, if our identifying assumption is validated, then we should expect that this mock treatment has no impact on our outcomes of interest.

As before, we ensure that every household in the treated districts in our analysis consists of at least one younger sibling exposed to the placebo treatment at age 6 and also older siblings unexposed at age 6.

The results for this falsification test are provided in Table 3.7. We find that the difference-in-differences estimator is statistically insignificant for all the outcome variables, further validating our identification assumption. These results are robust to the inclusion of birth order effects.

3.6.2 Additional Robustness Checks

In this sub-section, we perform a couple of robustness checks to see how sensitive the results are. First, we include district-specific time trends in our main specification – equation 1. The results are presented in the Appendix (Tables 3.A1 and 3.A2). We find that the results remain unchanged for each of the outcome variables.

Next, we cluster standard errors at the household level. The results are provided in Tables 3.A3 and 3.A4, for each of the outcome variables. Once again we find that the inference for all coefficients remain unchanged.

3.7 Discussion

The conclusions that can be drawn from the results suggest that the program led to significant gains in primary school completion rates, particularly for girls and children with five years of exposure. These findings confirm the channels that seem to be driving these results – the reduced marginal costs from attending school that arise from providing food grains and the increased incentives to the parents to send their children to school.

It is also extremely encouraging to find that the program effects persisted for girls even after the program ended in Grade 5. Eligible girls in the treated districts were more likely to complete grade 7 relative to those with no program exposure in the control districts.

It is worth mentioning that the estimated effects of the program are very likely underestimated in that not all eligible children in a district were reached by the program, owing to corruption and pilferage of the food grains by the Government officials. A field report conducted by the Comptroller and Auditor General (CAG 2002) indicates that there were significant program delays in the implementation, in the first phase of the scheme.[35] Further, a large proportion of students were deprived of the scheme due to corruption, particularly the misappropriation and misutilisation of food grains by the Government officials.

It must be noted that a caveat in our analysis is that we do not explicitly observe whether students repeated grades, in order to remain in primary school, so as to take advantage of the program. In order to address this, we estimate whether students completed Grade 5 on time, or whether they delayed completing primary school. Estimating whether the program encouraged grade repetition is equally important, from a policy perspective.

We find positive program effects on completion of lower primary school both by age 12 and by age 14. The main mechanism driving the results could plausibly be the nutritional benefit or value of the food grains, which could

---

[35] The Comptroller and Auditor General (CAG) of India is an authority, established by the Constitution of India, that audits all receipts and expenditures of the Government of India and the state governments.

in turn improve classroom concentration and academic achievement and therefore lead to completion on time.

It must also be noted that the program effects on completion by age 14 is larger than the program effects on completion by age 12. This provides suggestive evidence that the program encouraged children to defer completion of primary school through grade repetition, in order to benefit from the free food grains. Moreover, consistent with the results found in Chapter 2, this also indicates that the program encouraged older children (past the mandated school entry age) to start school. These children are less likely to complete primary school on time, since they started school late.

Thus far, we have focused on identifying the program effects for those who are directly exposed. In the subsequent section, we estimate spillover effects generated by the program by allowing for the possibility that the older siblings may have indirect exposure to the program by virtue of being in a household where the younger siblings has full or partial exposure to the program. We elaborate on this below.

3.8 Spillover effects

An additional feature of the methodology adopted is that there could potentially be within-household externalities onto the older sibling in the family, following the implementation of the program. These externalities could in turn influence the schooling outcomes of the older siblings, conditional on the fact that they belong to a beneficiary household.[36]

As explained in the methodology section, older siblings in the household are at least 12 years of age at the time of the introduction of the program and is therefore, not directly exposed. In this current context, we can categorise these older siblings into the following 3 types:

[36] We define a household to be a beneficiary household if at least one child in that household is exposed to the food rations program by being of primary school age and by residing in a treated district.

1. Type 1: They dropped out of primary school, before the implementation of the program or have never been to school
2. Type 2: They completed primary school before the implementation and is out of school at the time of implementation of the program
3. Type 3: They are enrolled in upper primary school or higher at the time of implementation

Given these aforementioned types, we allow for the possibility of spillover effects onto the older siblings. These are defined as follows:

Spillover effects can arise via the intra-household allocation of food grains if the older sibling is a part of a household where the younger sibling is a beneficiary of the program. One channel through which this might happen is if the food grains are equally distributed between all the siblings in the household, including the ineligible ones. Given this additional food-intake, the older sibling might enrol into secondary school or higher, thereby affecting their schooling outcomes inside the household.

Put differently, positive within-household externalities can occur if there is an increase in the proportion of type 3 individuals in the household as a consequence of the program, conditional on the older sibling being in a beneficiary household.

However, if the older sibling belongs to a beneficiary household and is not enrolled in upper primary school or higher at the time of implementation of the program (Types 1 and 2), then this would indicate that there are no educational spillover effects of the program onto the older sibling, as their schooling outcomes remain unaffected.

As such, we are able to isolate these spillover effects by checking whether the behaviour of the older siblings is influenced by the fact that the younger sibling is in primary school and is in receipt of food grains. We can do so by comparing whether the following 2 groups are more likely to enrol into secondary school or higher:

1. Group 1: Older siblings in the household who have younger siblings who do not have any exposure to the program

2. Group 2: Older siblings in the household who have younger siblings who have full exposure to the program

Group 1 does not have any direct or indirect exposure to the program, whereas Group 2 only has an indirect exposure to the program. We regard Group 2 as the treated group and correspondingly, Group 1 as the control group.

Essentially, we test for the presence of spillover effects by comparing the behaviour of older siblings in districts that launched the program earlier to districts that received the program later. We do so, by adopting a difference-in-differences estimation strategy. The difference-in-differences estimator allows us to check whether the schooling outcomes differ systematically between the two groups. If Group 2 is more likely to enrol into upper primary school or higher, following the program introduction than Group 1, then this provides evidence of spillover effects of the program. In that case, the total effect of the program can be decomposed into the direct effect plus the spillover effect.

Accordingly, we estimate the following specification.

$$y_{ijdy} = \alpha + \beta(Treated\ District_d * Treatment_{ij}) + \theta_y + \eta_d + \gamma_{sy} + \varepsilon_{ijdy} \quad (4)$$

Where, y_{ijdy} is an indicator for whether the older sibling i in household j in district d belonging to birth cohort y is enrolled in secondary school or higher. The treated district variable is a binary variable equal to one if the older sibling resides in a treated district and zero otherwise. We define the treated districts as those districts where the program rollout took place in 1995 and 1996, while the control districts refers to those districts where the program commenced in 1998. The treatment variable is an indicator, which picks up whether the older sibling i has a younger sibling who is fully exposed to the program. Cohort fixed effects θ_y, district fixed effects η_d and state level time trends γ_{sy} are included. We cluster standard errors at the district level.

The coefficient of interest, β is the difference-in-differences estimator. We would be able to conclude that spillover effects exist if β is significantly different from zero and the sign would indicate whether there are positive or negative externalities of the program onto the schooling outcomes of the older sibling.

We estimate equation (4) using the combined sample of DLHS 2 and 3. We focus on a sample of older siblings who have already completed primary school before the program launch (Type 2). We do so, because we would like to test whether their decision to enrol into secondary school changes at the margin, given that they have younger siblings eligible for the program. We exclude older siblings who never went to school or those who dropped out of primary school before the program launch, as they would not be deciding whether to enter secondary school at the time of the program rollout. As such, the program would not influence their decision to enrol into secondary school or higher.

The results from estimating equation (4) are provided in Table 3.8. We do not find evidence of spillover effects. The difference-in-differences estimator is statistically insignificant which implies that the program did not influence the decision to enrol into secondary school or higher for older siblings in the family who have younger siblings who are eligible for the take home rations program.

One possible explanation for this could be the fact that these children are older and so, the marginal benefits from entering the labour market are higher than enrolling into secondary school. As such, this additional food-intake provided at home due to the food grains distributed does not provide any incentive to the child to enrol into secondary school. However, it may actually encourage them to enter the labour market.

In column 3, we allow for differential program effects by gender. The results do not change. Once again, we find that this indirect exposure to the program did not affect the schooling outcomes of the older sibling in a beneficiary household.

3.9 Conclusion

In order to boost enrolment, attendance and to improve the nutritional status of children, the Government of India launched the National Program of Nutritional support to Primary education in 1995. The policy was initially implemented by distributing food grains to students enrolled in Grades 1 to 5 in Government schools.

In this chapter, we evaluated the impact of the National Program of Nutritional support to Primary education on primary school completion. In light of the scarce evidence that exists on the effectiveness of school-feeding programs on educational attainment, this chapter seeks to address this gap in the research literature. Further, studying whether these programs encourage children to complete primary school is of particular relevance to policy makers.

We adopted a difference-in-differences estimation strategy to estimate the program effects, by exploiting the district-level variation in the implementation of the program, in addition to the variation in program exposure between siblings in the household.

Using the second and third round of the District level Household survey, we find evidence that the provision of food grains led to an increase in the likelihood of lower primary school (Grade 5) completion. We also observe that the program effects did not fade out, as we find a positive effect of the program on Grade 7 completion, predominantly for girls. We also find suggestive evidence that the program encouraged children to stay in school longer, by delaying completion of primary school, in order to benefit from the program.

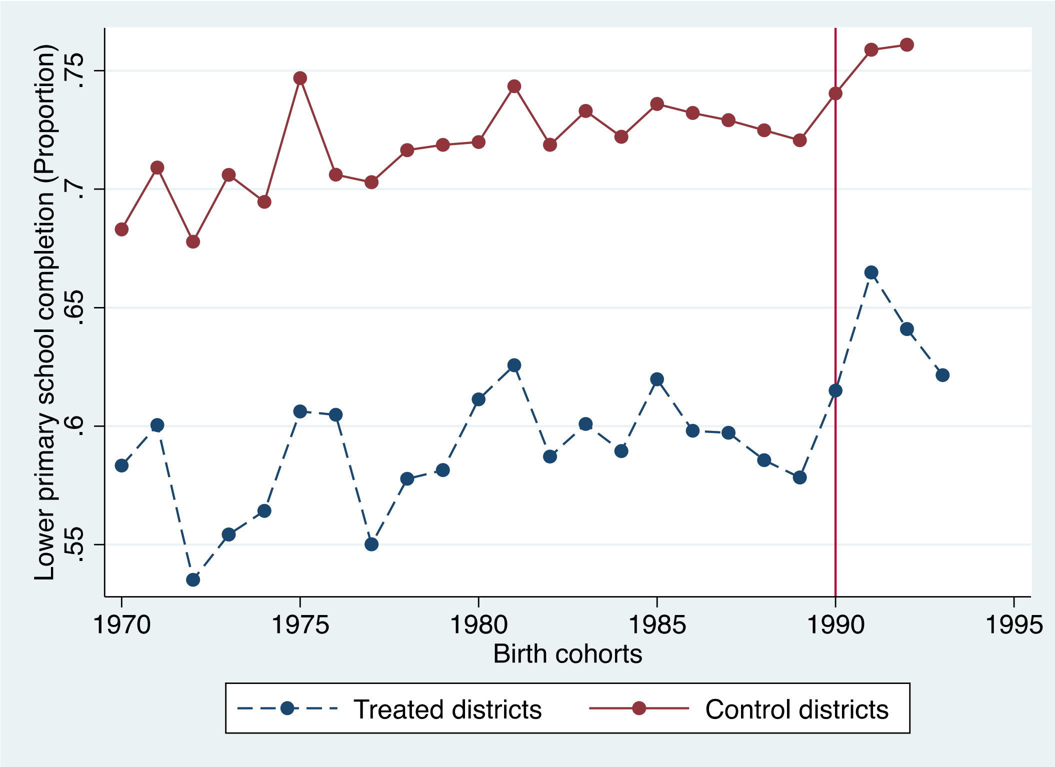
Further, we attempted to estimate spillover effects generated by the program onto the educational outcomes of older siblings in the family, who are past primary school age. More specifically, we estimated whether having a younger sibling, who is of primary school age and with exposure to the program affects the secondary school enrolment decisions of older siblings in the family. We find no evidence of spillover effects of the program. Some explanations could be that the indirect exposure to the program (through their younger siblings) was not significant enough to incentivise older siblings to enrol in secondary school. Also, the opportunity costs for older siblings to enrol in secondary school maybe higher since the marginal benefits from entering the labour force are large.

It must be pointed out that the measured effects of the program may very likely be underestimated in that not all eligible children in a district were reached by the program, owing to corruption and pilferage of the food grains by the Government officials and also perhaps due to the non compliance or partial compliance by the schools in implementing the scheme. An inspection report by the Comptroller and Auditor General (CAG, 2002) of India documents that a significant fraction of students were deprived of the program due to organisational difficulties in the execution and monitoring of the scheme. Corruption, particularly the misappropriation and misutilisation of food grains by the officials was the main reason behind the poor performance of the program.

In spite of the malfeasance, the positive effects of the program seem encouraging. As noted by the CAG report, the continued success of the program depends on better organisation by the officials in the enforcement of the scheme. Putting penalties in place for fraudulent behaviour could go a long way in improving the performance of the scheme. This holds not only for the take home rations program but also for the cooked meal program that has been in place across the country since 2001.

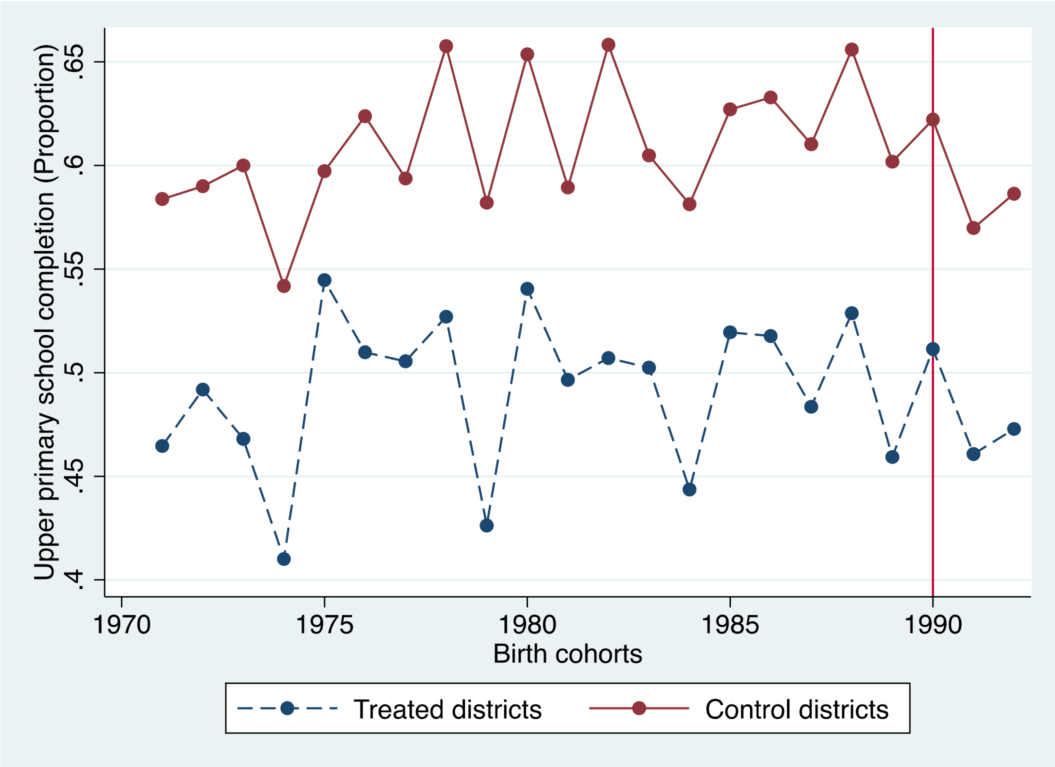
In conclusion, the impact of the take home rations program has important implications for future policies not only in the Indian context, but potentially, can also be generalised to other developing countries. Future research may be inclined to study the long-run effects of school feeding programs, which may be of particular importance to policy makers.

Figure 3.1: Trends in outcome variable (Lower primary school completion)



Notes: This figure plots the trends in Lower primary school completion against the different birth cohorts, separately for the treated and control districts. This has been constructed using the combined sample of DLHS 2 and 3. Cohorts born at or after 1990 are fully exposed to the program in the treated districts (as the program is available at the stipulated school starting age). All union territories and the states of Gujarat, Kerala and Tamil Nadu have been excluded. Households with one child or no children have been dropped.

Figure 3.2: Trends in outcome variable (Upper primary school completion)



Notes: This figure plots the trends in Upper primary school (Grade 7) completion against the different birth cohorts, separately for the treated and control districts. This has been constructed using the combined sample of DLHS 2 and DLHS 3. Cohorts born at or after 1990 are fully exposed to the program in the treated districts (as the program is available at the stipulated school starting age). All union territories and the states of Gujarat, Kerala and Tamil Nadu have been excluded. Households with one child or no children have been dropped.

Table 3.1: Descriptive statistics from District level household survey

Household Characteristics:	
Male	51.25
Hindus	71.16
Muslims	10.53
Schedules Caste	30.11
Scheduled Tribe	5.85
Average Household size	6.07
Average Number of children in the household	3.61
Average completed years of schooling - Mother	6.07
Average completed years of schooling - Father	7.52
Lower Primary school completion rates (in percentage)	
All	65.7
Male	72.23
Female	58.99
Upper Primary school completion rates (in percentage)	
All	54.8
Male	59.62
Female	48.87

Notes: The descriptive statistics have been constructed from the combined sample of DLHS 2 and 3 for all characteristics. The cohorts in question are those born between 1970 and 1993. Households with one child or no children have been dropped. The states of Gujarat, Kerala and Tamil Nadu as well as all the union territories have been excluded.

Table 3.2: Pre-treatment Characteristics

Characteristics	Treated districts	Control districts	Difference
Lower primary school completion (proportion)	0.600	0.720	-0.120***
			(0.011)
Upper primary school completion (proportion)	0.490	0.599	-0.109***
			(0.012)
Household Characteristics			
Male	0.507	0.521	-0.014
			(0.012)
Hindus	0.684	0.740	-0.056**
			(0.024)
Muslims	0.144	0.066	0.078***
			(0.020)
Schedules Caste	0.243	0.349	-0.106***
			(0.019)
Scheduled Tribe	0.048	0.065	-0.017***
			(0.016)
Household size	7.645	7.529	0.117
			(0.084)
Number of children in the household	3.349	3.220	0.129
			(0.090)
Completed years of education - Mother	6.071	7.066	-0.995
			(0.687)
Completed years of education - Father	7.141	8.009	-0.869
			(0.532)

Notes: The descriptive statistics have been constructed from the combined sample of DLHS 2 and 3 for all characteristics. The cohorts in question are those that are 12 years or older at the time of program implementation. Households with one child or no children have been dropped. The states of Gujarat, Kerala and Tamil Nadu as well as all the union territories have been excluded. The treated districts refer to the districts that implemented the program in 1995 and 1996. The control districts are the remaining districts that implemented the program in 1998. The differences reported in the last column are the difference in characteristics between the treated and control districts. We test whether the differences are significantly different using a standard t-test. Standard errors are in parenthesis (*** p<0.01, ** p<0.05, * p<0.1).

Table 3.3: Results from testing identification assumptions- Event study analysis

	Lower primary school completion		Upper primary school completion	
	(1)	(2)	(3)	(4)
Treatment_Cohort 1972	-0.0302	-0.0297	-0.074	-0.107
	(0.024)	(0.029)	(0.072)	(0.074)
Treatment_Cohort 1973	-0.033	-0.038	-0.090	-0.112
	(0.032)	(0.028)	(0.07)	(0.075)
Treatment_Cohort 1974	0.015	0.008	0.0197	0.0218
	(0.024)	(0.024)	(0.032)	(0.034)
Treatment_Cohort 1975	0.049	0.043	0.0209	0.0230
	(0.029)	(0.023)	(0.027)	(0.023)
Treatment_Cohort 1976	0.040	0.033	0.0223	0.0242
	(0.039)	(0.029)	(0.025)	(0.028)
Treatment_Cohort 1977	0.160	0.148	0.0141	0.0155
	(0.252)	(0.252)	(0.028)	(0.028)
Treatment_Cohort 1978	-0.001	-0.010	0.0118	0.0133
	(0.030)	(0.031)	(0.025)	(0.025)
Treatment_Cohort 1979	-0.014	-0.028	0.0120	0.0133
	(0.027)	(0.021)	(0.026)	(0.021)
Treatment_Cohort 1980	-0.003	-0.003	0.045	0.066
	(0.023)	(0.020)	(0.045)	(0.050)
Treatment_Cohort 1981	-0.006	-0.012	0.064	0.084
	(0.021)	(0.021)	(0.056)	(0.057)
Treatment_Cohort 1982	0.046	0.037	0.093	0.110
	(0.039)	(0.038)	(0.080)	(0.081)
Treatment_Cohort 1983	-0.005	-0.005	0.075	0.091
	(0.021)	(0.022)	(0.074)	(0.077)
Treatment_Cohort 1984	-0.006	-0.018	0.037	0.052
	(0.022)	(0.021)	(0.027)	(0.038)
Treatment_Cohort 1985	0.030	0.021	0.011	0.0129
	(0.021)	(0.021)	(0.026)	(0.026)
Treatment_Cohort 1986	0.017	0.007	0.093	0.110
	(0.015)	(0.011)	(0.06)	(0.064)
Treatment_Cohort 1987	0.010	0.021	0.045	0.061
	(0.021)	(0.021)	(0.046)	(0.048)
Treatment_Cohort 1988	0.003	0.013	0.071	0.087
	(0.005)	(0.010)	(0.045)	(0.05)
Treatment_Cohort 1989	0.036	0.026	0.0117	0.0134
	(0.030)	(0.031)	(0.026)	(0.026)

Note: Table continued

Table 3.3 continued: Results from testing identification assumptions- Event study analysis

	Lower primary school completion		Upper primary school completion	
	(1)	(2)	(3)	(4)
Treatment_Cohort 1990	0.030***	0.029***	0.015***	0.018***
	(0.007)	(0.005)	(0.004)	(0.005)
Treatment_Cohort 1991	0.038***	0.039***	0.018***	0.016***
	(0.010)	(0.010)	(0.007)	(0.009)
Treatment_Cohort 1992	0.019***	0.019***	0.014***	0.012**
	(0.007)	(0.007)	(0.004)	(0.005)
Treatment_Cohort 1993	0.028***	0.030***	0.018***	0.019***
	(0.006)	(0.007)	(0.005)	(0.005)
female	-0.086***	-0.066***	-0.076***	-0.054***
	(0.006)	(0.006)	(0.003)	(0.004)
District fixed effects	Yes	Yes	Yes	Yes
Cohort fixed effects	Yes	Yes	Yes	Yes
State specific time trends	Yes	Yes	Yes	Yes
Constant	0.640***	0.606***	0.506***	0.500***
	(0.030)	(0.031)	(0.031)	(0.030)
Observations	292,395	292,395	292,395	292,395
R-squared	0.105	0.107	0.118	0.119

Notes: The results presented are derived from estimating Equation (2) using the combined sample of DLHS 2 and DLHS 3 to test whether the treated districts and the control districts follow the same trends in lower primary school completion (Columns 1 and 2) and upper primary school completion (Columns 3 and 4). We interact the cohort indicators with the treated districts indicator. The omitted category is the interaction between the 1971 cohort and the treated districts. We also include cohort and district fixed effects. Cohorts born at or after 1990 are fully exposed to the program in the treated districts, while cohorts born prior to 1990 have no exposure or partial exposure to the program. We cluster standard errors at the district level (*** p<0.01, ** p<0.05, * p<0.1).

Table 3.4: Effect of the program on Lower Primary school completion

	(1)	(2)	(3)	(4)
Lower Primary school completion				
treatment_post	0.028***	0.008	0.018***	
	(0.006)	(0.007)	(0.007)	
treatment_post_female		0.054***	0.030***	
		(0.006)	(0.007)	
treatment_1 year of exposure				0.018
				(0.015)
treatment_2 years of exposure				0.008
				(0.019)
treatment_3 years of exposure				0.019
				(0.016)
treatment_4 years of exposure				0.028
				(0.019)
treatment_5 years of exposure				0.036***
				(0.014)
female	-0.109***	-0.126***	-0.102***	-0.109***
	(0.006)	(0.007)	(0.008)	(0.006)
post_female		0.038***	0.043***	
		(0.004)	(0.004)	
treatment_female		-0.059***	-0.072***	
		(0.006)	(0.006)	
Household fixed effects	Yes	Yes	Yes	Yes
Cohort fixed effects	Yes	Yes	Yes	Yes
Birth order effects	No	No	Yes	Yes
State specific time trends	Yes	Yes	Yes	Yes
Constant	0.637***	0.640***	0.606***	0.636***
	(0.031)	(0.030)	(0.031)	(0.031)
Outcome Mean (Pre program)	0.657	0.657	0.657	0.657
Observations	292,395	292,395	292,395	292,395
R-squared	0.035	0.036	0.038	0.035
Number of households	30,653	30,653	30,653	30,653

Notes: We use the combined sample of DLHS 2 and 3 to estimate the effect of the program on lower primary school (grade 5) completion. The dependent variable is an indicator for completion of Grade 5. Treatment is an indicator picking up the treated districts. The Post variable picks up the younger siblings in the family. In column 2, we allow for the possibility of heterogeneous program effects by gender. In column 3, we allow for birth order effects by including an indicator for the second, third, etc. child in the family. The excluded category is the first child. In column 4, we allow for differential program effects by years of exposure. Outcome mean reports the mean of the outcome variable in the pre-program period. The standard errors are clustered at the district level (*** p<0.01, ** p<0.05, * p<0.1)

Table 3.5: Effect of the program on Upper primary school completion

	(1)	(2)	(3)	(4)
Upper Primary school completion				
treatment_post	0.018*	0.008	0.003	
	(0.009)	(0.010)	(0.010)	
treatment_post_female		0.015***	0.016***	
		(0.005)	(0.005)	
treatment_1 year of exposure				0.021
				(0.015)
treatment_2 years of exposure				0.017
				(0.020)
treatment_3 years of exposure				0.018
				(0.014)
treatment_4 years of exposure				0.004
				(0.026)
treatment_5 years of exposure				0.012**
				(0.005)
female	-0.116***	-0.139***	-0.111***	-0.093***
	(0.003)	(0.004)	(0.005)	(0.004)
post_female		0.054***	0.060***	
		(0.005)	(0.005)	
treatment_female		-0.068***	-0.086***	
		(0.007)	(0.007)	
Household fixed effects	Yes	Yes	Yes	Yes
Cohort fixed effects	Yes	Yes	Yes	Yes
Birth order effects	No	No	Yes	Yes
State specific time trends	Yes	Yes	Yes	Yes
Constant	0.552***	0.556***	0.506***	0.500***
	(0.030)	(0.030)	(0.031)	(0.030)
Outcome Mean (pre program)	0.548	0.548	0.548	0.548
Observations	292,395	292,395	292,395	292,395
R-squared	0.034	0.036	0.038	0.038
Number of households	30,653	30,653	30,653	30,653

Notes: We use the combined sample of DLHS 2 and 3 to estimate the effect of the program on upper primary school (grade 7) completion. The dependent variable is an indicator for completion of Grade 7. Treatment is an indicator picking up the treated districts. The Post variable picks up the younger siblings of primary-school age in the family. In column 2, we allow for the possibility of heterogeneous program effects by gender. In column 3, we allow for birth order effects by including an indicator for the second, third, etc. child in the family. The excluded category is the first child. In column 4, we allow for differential program effects by years of exposure. Outcome mean reports the mean of the outcome variable in the pre-program period. The standard errors are clustered at the district level (*** p<0.01, ** p<0.05, * p<0.1).

Table 3.6: Effect of the program on completion of lower primary school on time

	Completed lower primary school by age 12		Completed lower primary school by age 14	
	(1)	(2)	(3)	(4)
treatment_post	0.017***	0.016***	0.042***	0.043***
	(0.006)	(0.006)	(0.004)	(0.008)
female	-0.133***	-0.108***	-0.109***	-0.089***
	(0.003)	(0.004)	(0.003)	(0.003)
District fixed effects	Yes	Yes	Yes	Yes
Cohort fixed effects	Yes	Yes	Yes	Yes
Birth order effects	No	Yes	No	Yes
State specific time trends	Yes	Yes	Yes	Yes
Constant	0.683***	0.650***	0.737***	0.702***
	(0.028)	(0.028)	(0.026)	(0.026)
Observations	92,395	92,395	88,262	88,262
R-squared	0.035	0.626	0.58	0.648

Notes: We use the combined sample of DLHS 2 and 3 to estimate the effect of the program on lower primary school (grade 5) completion on time. The dependent variable is an indicator for completion of Grade 5 by age 12 (in columns 1 and 2) and completion of Grade 5 by age 14 (in columns 3 and 4). Treatment is an indicator picking up the treated districts. The Post variable picks up the younger siblings of primary school age in the family. In columns 2 and 4, we allow for birth order effects. Standard errors are clustered at the district level (*** p<0.01, ** p<0.05, * p<0.1)

Table 3.7: Effect of the Placebo treatment on Primary school completion

	Grade 5 Completion		Grade 7 completion	
	(1)	(2)	(3)	(4)
Treatment_post	-0.001	-0.003	-0.011	-0.010
	(0.007)	(0.007)	(0.009)	(0.010)
Treatment_post_female		0.009		0.007
		(0.007)		(0.008)
Female	-0.116***	-0.104***	-0.115***	-0.098***
	(0.003)	(0.005)	(0.004)	(0.005)
Post_female		-0.003		-0.005
		(0.006)		(0.007)
Treatment_female		-0.045		-0.052
		(0.033)		(0.037)
Household Fixed effects	Yes	Yes	Yes	Yes
Cohort fixed effects	Yes	Yes	Yes	Yes
Birth order effects	No	Yes	No	Yes
State specific time trends	Yes	Yes	Yes	Yes
Constant	0.755***	0.732***	0.611***	0.581***
	(0.016)	(0.016)	(0.017)	(0.018)
Observations	168,958	168,958	168,958	168,958
R-squared	0.033	0.036	0.041	0.043
Number of households	22,250	22,250	22,250	22,250

Notes: We falsely assume that the program was implemented in 1990 in the districts where the program actually began in 1995 and 1996. Finally, we pretend that this mock treatment was extended to the remaining districts in 1993. We use the combined sample of DLHS 2 and 3 to test whether this placebo treatment affected primary school completion. The cohorts under consideration are those born between 1970 and 1987, as they do not have exposure to the actual treatment at age 6 in 1995. In column 2 and 4, we allow for the possibility of heterogeneous program effects by interacting the treatment_post variable with a female dummy. We also allow for birth order effects in Column 2 and 4. The standard errors are clustered at the district level (*** p<0.01, ** p<0.05, * p<0.1).

Table 3.8: Testing for the presence of spillover effects

	(1)	(2)	(3)
Enrolment into secondary school			
Treated_district * Treatment	0.037	0.030	0.033
	(0.086)	(0.084)	(0.087)
Treated_district * Treatment * female			0.010
			(0.021)
Female		-0.054***	-0.072***
		(0.008)	(0.023)
District fixed effects	Yes	Yes	Yes
Cohort fixed effects	Yes	Yes	Yes
State specific time trends	Yes	Yes	Yes
Constant	0.523***	0.535***	0.517***
	(0.062)	(0.060)	(0.062)
Outcome Mean	0.519	0.519	0.519
Observations	116,170	116,170	116,170
R-squared	0.069	0.072	0.072

Notes: We use the combined sample of DLHS 2 and 3 to identify spillover effects. We restrict our sample to include only older siblings in the family, who are 12 years of age at the time of program implementation. The dependent variable is an indicator for whether the older sibling enrolled into secondary school. Treated_district is an indicator for the districts that implemented the program in 1995 and 1996. The treatment variable is an indicator, which picks up whether older siblings in the family have a younger sibling(s), eligible for the program in the household. We cluster standard errors at the district level (*** p<0.01, ** p<0.05, * p<0.1).

Appendix

Table 3.A1: Effect of the program on Lower Primary school completion (Robustness Checks)

	(1)	(2)	(3)	(4)
Lower Primary school completion				
treatment_post	0.029***	0.009	0.019**	
	(0.009)	(0.010)	(0.009)	
treatment_post_female		0.054***	0.030***	
		(0.006)	(0.006)	
treatment_1 year of exposure				0.019
				(0.018)
treatment_2 years of exposure				0.006
				(0.022)
treatment_3 years of exposure				0.009
				(0.017)
treatment_4 years of exposure				0.010
				(0.026)
treatment_5 years of exposure				0.034**
				(0.014)
female	-0.109***	-0.126***	-0.102***	-0.089***
	(0.003)	(0.003)	(0.004)	(0.003)
post_female		0.039***	0.043***	
		(0.004)	(0.004)	
treatment_female		-0.060***	-0.072***	
		(0.006)	(0.006)	
Household fixed effects	Yes	Yes	Yes	Yes
Cohort fixed effects	Yes	Yes	Yes	Yes
Birth order effects	No	No	Yes	Yes
District specific time trends	Yes	Yes	Yes	Yes
Constant	0.620***	0.621***	0.682***	0.677***
	(0.046)	(0.046)	(0.047)	(0.047)
Observations	292,395	292,395	292,395	292,395
R-squared	0.035	0.036	0.038	0.038
Number of households	30,653	30,653	30,653	30,653

Notes: We use the combined sample of DLHS 2 and 3 to estimate the effect of the program on lower primary school (grade 5) completion. The dependent variable is an indicator for completion of Grade 5. Treatment is an indicator picking up the treated districts. The Post variable picks up the younger siblings of primary-school age in the family. In column 2, we allow for the possibility of heterogeneous program effects by gender. In column 3, we allow for birth order effects by including an indicator for the second, third, etc. child in the family. The excluded category is the first child. In column 4, we allow for differential program effects by years of exposure. As a robustness check, we include district-specific time trends in the specification. The standard errors are clustered at the district level (*** p<0.01, ** p<0.05, * p<0.1).

Table 3.A2: Effect of the program on Upper primary school completion (Robustness checks)

Upper Primary school completion	(1)	(2)	(3)	(4)
treatment_post	0.019*	0.004	0.004	
	(0.010)	(0.011)	(0.011)	
treatment_post_female		0.022***	0.014***	
		(0.007)	(0.007)	
treatment_1 year of exposure				0.021
				(0.016)
treatment_2 years of exposure				0.017
				(0.022)
treatment_3 years of exposure				0.018
				(0.015)
treatment_4 years of exposure				0.004
				(0.028)
treatment_5 years of exposure				0.012**
				(0.005)
female	-0.116***	-0.139***	-0.111***	-0.093***
	(0.003)	(0.004)	(0.005)	(0.004)
post_female		0.054***	0.060***	
		(0.005)	(0.005)	
treatment_female		-0.069***	-0.086***	
		(0.007)	(0.007)	
Household fixed effects	Yes	Yes	Yes	Yes
Cohort fixed effects	Yes	Yes	Yes	Yes
Birth order effects	No	No	Yes	Yes
District specific time trends	Yes	Yes	Yes	Yes
Constant	0.652***	0.595***	0.595***	0.590***
	(0.055)	(0.056)	(0.056)	(0.056)
Observations	292,395	292,395	292,395	292,395
R-squared	0.034	0.038	0.038	0.037
Number of households	30,653	30,653	30,653	30,653

Notes: We use the combined sample of DLHS 2 and 3 to estimate the effect of the program on upper primary school (grade 7) completion. The dependent variable is an indicator for completion of Grade 7. Treatment is an indicator picking up the treated districts. The Post variable picks up the younger siblings of primary-school age in the family. In column 2, we allow for the possibility of heterogeneous program effects by gender. In column 3, we allow for birth order effects by including an indicator for the second, third, etc. child in the family. The excluded category is the first child. In column 4, we allow for differential program effects by years of exposure. As a robustness check, we include district-specific time trends in the specification. The standard errors are clustered at the district level (*** p<0.01, ** p<0.05, * p<0.1).

Table 3.A3: Effect of the program on Lower Primary school completion (Robustness checks)

Lower Primary school completion	(1)	(2)	(3)	(4)
treatment_post	0.028***	0.008	0.018**	
	(0.007)	(0.007)	(0.007)	
treatment_post_female		0.054***	0.030***	
		(0.005)	(0.006)	
treatment_1 year of exposure				0.018
				(0.015)
treatment_2 years of exposure				0.008
				(0.017)
treatment_3 years of exposure				0.009
				(0.015)
treatment_4 years of exposure				0.008
				(0.019)
treatment_5 years of exposure				0.036***
				(0.012)
female	-0.109***	-0.126***	-0.102***	-0.109***
	(0.003)	(0.003)	(0.004)	(0.003)
post_female		0.038***	0.048***	
		(0.004)	(0.004)	
treatment_female		-0.059***	-0.079***	
		(0.006)	(0.006)	
Household fixed effects	Yes	Yes	Yes	Yes
Cohort fixed effects	Yes	Yes	Yes	Yes
Birth order effects	No	No	Yes	Yes
State specific time trends	Yes	Yes	Yes	Yes
Constant	0.637***	0.640***	0.606***	0.636***
	(0.030)	(0.030)	(0.030)	(0.030)
Observations	292,395	292,395	292,395	292,395
R-squared	0.035	0.036	0.038	0.035
Number of households	30,653	30,653	30,653	30,653

Notes: We use the combined sample of DLHS 2 and 3 to estimate the effect of the program on lower primary school (grade 5) completion. The dependent variable is an indicator for completion of Grade 5. Treatment is an indicator picking up the treated districts. The Post variable picks up the younger siblings of primary-school age in the family. In column 2, we allow for the possibility of heterogeneous program effects by gender. In column 3, we allow for birth order effects by including an indicator for the second, third, etc. child in the family. The excluded category is the first child. In column 4, we allow for differential program effects by years of exposure. The standard errors are clustered at the household level (*** p<0.01, ** p<0.05, * p<0.1).

Table 3.A4: Effect of the program on Upper primary school completion (Robustness checks)

	(1)	(2)	(3)	(4)
Upper Primary school completion				
treatment_post	0.018*	0.008	0.003	
	(0.009)	(0.011)	(0.010)	
treatment_post_female		0.015***	0.016***	
		(0.005)	(0.004)	
treatment_1 year of exposure				0.021
				(0.015)
treatment_2 years of exposure				0.016
				(0.020)
treatment_3 years of exposure				0.018
				(0.014)
treatment_4 years of exposure				0.004
				(0.026)
treatment_5 years of exposure				0.012**
				(0.005)
female	-0.116***	-0.139***	-0.111***	-0.093***
	(0.003)	(0.004)	(0.005)	(0.004)
post_female		0.054***	0.060***	
		(0.005)	(0.005)	
treatment_female		-0.068***	-0.086***	
		(0.007)	(0.007)	
Household fixed effects	Yes	Yes	Yes	Yes
Cohort fixed effects	Yes	Yes	Yes	Yes
Birth order effects	No	No	Yes	Yes
State specific time trends	Yes	Yes	Yes	Yes
Constant	0.552***	0.556***	0.506***	0.500***
	(0.030)	(0.031)	(0.031)	(0.030)
Observations	292,395	292,395	292,395	292,395
R-squared	0.034	0.036	0.038	0.038
Number of households	30,653	30,653	30,653	30,653

Notes: We use the combined sample of DLHS 2 and 3 to estimate the effect of the program on upper primary school (grade 7) completion. The dependent variable is an indicator for completion of Grade 7. Treatment is an indicator picking up the treated districts. The Post variable picks up the younger siblings of primary-school age in the family. In column 2, we allow for the possibility of heterogeneous program effects by gender. In column 3, we allow for birth order effects by including an indicator for the second, third, etc. child in the family. The excluded category is the first child. In column 4, we allow for differential program effects by years of exposure. The standard errors are clustered at the household level (*** p<0.01, ** p<0.05, * p<0.1).

SECTION B:

The impact of a Government School Health program in India on pupils' educational and health outcomes

Abstract:

In this section of the thesis, we evaluate the impact of a School Health Program implemented in public primary schools in the South Indian state of Karnataka. The program is unique as it mandated the provision of micronutrient supplementation, deworming medication, in combination with regular health check-ups to be conducted by Doctors at the school premises. All students enrolled in public primary schools in the state were eligible for these health services, free of cost.

As such, this study complements section A of this thesis, which is related to studying the effect of the National program of nutritional support to primary education or the Mid-day meal scheme implemented by the Government of India. Both the School Health Program and the Mid-day meal scheme are complementary programs that are presently being implemented in Karnataka by the Government. The latter program was initially being implemented by providing food-rations to students enrolled in primary school. However, since 2002 onwards, the program has transitioned from the provision of food-grains to the daily provision of cooked school meals in all Government primary schools in Karnataka.

Additionally, since 2006, the Government of Karnataka has also been implementing the School Health program in primary schools in the state. By 2012, almost all public schools in the state have been covered by the program. Other states in India have also introduced the program with varying degrees of coverage and the scope of the program also differs in terms of the health services offered to the students.

Both the Mid-day meals program and the School Health program seek to improve the health and nutritional status of children and are considered mutually beneficial, as proper nutrition is undermined in the presence of infections. As a consequence, these programs have the potential to improve schooling outcomes of children in developing countries.

The focus of Section B of this thesis is to study whether the School Health program implemented in Karnataka was effective in improving the

educational and health status of children. In particular, the research questions we seek to answer are whether the School Health program: (i) led to an increase in school participation (ii) improved the academic performance of students and (iii) resulted in improvements in health outcomes of students.

Distinct from section A, this study uses a novel dataset that combines administrative data on students' academic and health records, collected from 50 Government primary schools in Karnataka, India. The data collection took place from schools, managed by the Department of Education, Government of Karnataka, located in Bangalore Urban district and Bangalore Rural district.

The identification strategy exploits the fact that the program was phased in sequentially across public primary schools in the sample between 2006 and 2008. Accordingly, we employ a difference-in-differences framework to estimate the program impact on schooling and health outcomes. We find positive program effects on school participation indicators as well as students' academic performance, with heterogeneous program effects by gender, grade, years of program exposure and across the performance distribution. The program impacts on anthropometric indicators (weight-for-age and height-for-age z scores) are positive, but statistically insignificant.

This study seeks to contribute to the related literature that evaluates the impact of health interventions on educational and health outcomes. This paper also serves as a crucial form of program evaluation in the Indian context. The results from this analysis would be important for the Government of Karnataka and would also have an external validity to other states in India and other developing countries.

4.1 Introduction

Poor health and nutrition stemming from poverty and illiteracy are the fundamental problems afflicting children in developing countries (Glewwe and Miguel, 2008). This, in turn, hinders physical and mental growth and development during the critical period of development and increases susceptibility to infections (Jukes, 2006). In addition, this leads to adverse effects on children's educational attainment and their prospects on the labour market and lifetime earnings (Behrman, 1996; Alderman et al., 2001; Glewwe et al., 2001). Evidence from the research literature has indicated that investments made towards improving health during the ages of 5 and 15 can reverse the consequences of suboptimal environments in early childhood and can lead to improved health status of children (Jukes, Drake & Bundy, 2008; Attanasio et al., 2015; Schott et al., 2013; Lundeen et al., 2014).

The most common health problems faced by school-aged children in the developing world include worm infestations, acute respiratory infections (ARIs), malnutrition, micronutrient deficiencies, malaria and to a lesser extent, visual acuity disorders and human immunodeficiency virus (Bundy et al., 2006).

The United Nations World Food Programme (WFP) reports that malnutrition and micronutrient deficiencies are extremely prevalent in developing countries, with nearly 100 million children being underweight and one in three children exhibiting stunted growth. In terms of micronutrient deficiencies, iron deficiency anaemia is highly endemic in low-income countries. The World Health Organization (WHO) estimates that nearly 40% of preschool children are anaemic in developing countries. This is further exacerbated by worm infestations. Bundy (1997) estimates that between 25 and 35 percent of school age children are suffering from worm infestations.

ARIs, particularly upper respiratory tract infections and ear infections, are extremely common among school children, and are a major cause of school absenteeism. With regards to visual acuity disorders, Bundy et al. (2003) report that about 10% of school age (5-15 years old) children have refraction errors. They further note that almost all refraction errors can be corrected with properly fitted eyeglasses, but that children in low-income settings do not have spectacles or even access to health care providers.

Evidence from the research literature suggests that the poor health and nutritional status of children not only reduces the time spent in school due to repeated absences, but also undermines their learning during that time (Miguel & Kremer, 2004). As such, ill health and inadequate nutrition are detrimental to children's school participation, cognitive ability and their academic achievement and progression. Policies implemented that are targeted at improving children's health and nutritional status could also directly improve their educational outcomes. This link could be a key mechanism to improve the quality of life in less developed countries (Glewwe & Miguel, 2008; Dupas & Miguel, 2016).

Governments and policy makers have identified schools to be a cost-effective delivery mechanism for the provision of health services (Bundy, 2011). There is growing recognition of the importance of school-based health programs in promoting the health and hygiene of children in developing countries. School health services are uniquely placed as they remove any barriers that may exist in accessing health services in low-income countries (Dupas and Miguel, 2016). Further, these services are often provided free of cost, making health care more accessible and affordable, encouraging children to seek treatment.

Thus, the focus of this paper is to evaluate the impact of a School Health Program introduced by the Government of Karnataka, India in 2006. The program is a comprehensive health intervention that is provided to all students enrolled in Public primary schools, free of cost. This integrated health package prescribes the regular provision of deworming medication, in addition to micronutrient supplementation (vitamin A and iron) to students enrolled in government schools. Moreover, an integral, unique part of the program incorporates regular Health screenings of students to be conducted by a team of trained Doctors on school grounds. At the health checks, children diagnosed with serious ailments are referred to specialists in local hospitals, where they are provided with free treatment.

The program was phased in sequentially across public primary schools in Karnataka, starting from 2006. By 2012, almost all government schools in the state have been covered by the program. Over 3 million school children were medically examined on the health screening days held at the schools in 2013 (Government of Karnataka, 2016). Similar school-based health programs have also been implemented in other states in India, with varying degrees of coverage.

The objective of this paper is to evaluate whether the School Health program was effective in improving students' educational outcomes and health status. In particular, we are interested in identifying the causal impact of the program on school participation, academic performance and health outcomes. The main mechanism by which the program could influence school participation is by reducing the absences resulting from student illnesses (Miguel and Kremer, 2004). The program also has the potential to improve pupils' academic performance by increasing time spent in school and moreover, the improved health status could boost classroom concentration and attentiveness.

We identify the program impact using administrative data on students' academic and health records that have been collected from 50 Government schools. The data collection took place from schools located in 2 districts in Karnataka, namely Bangalore urban district and Bangalore rural district. All schools in our study are managed by the Department of Education, Government of Karnataka. The academic and health records of the pupils have been combined to create a unique panel dataset that contain comprehensive accounts of the students' academic progress and health status.

We adopt a difference-in-differences (DID) estimation strategy to estimate the program impact, exploiting the staggered implementation of the program across schools in Karnataka. Thus, we compare the educational and health outcomes of students, between schools that implemented the program in 2006 (treated schools) to those that implemented it 2 years later, in 2008 (control schools).

Results indicate that the program led to an increase in attendance, exam take-up rates and led to a decrease in long-term absence of students in the treated schools, relative to the control schools.[37] We further find positive program effects on Standardized Math test scores, with heterogeneous effects across the performance distribution. We also find differential program effects by grade, gender and years of program exposure. The program impacts on anthropometric indicators (weight-for-age and height-for-age z scores) are positive, but statistically insignificant for both boys and girls.

This study seeks to contribute to the related literature that identifies the impact of school based health interventions on schooling and health outcomes in developing countries. It must be pointed out that previous work (Miguel and Kremer, 2004; Bobonis et al., 2006; Glewwe, et al., 2014) analyses the impact of a specific health intervention in schools. This study is distinct as we evaluate a comprehensive health program that incorporates a variety of health interventions into one all-inclusive program. Moreover, the program we study is unique as students' health status is monitored at regular intervals throughout the duration of primary school unlike previous work, which have mainly been short-term interventions. This is novel from an academic and policy perspective.

We anticipate that the results of this research project will be beneficial to the Government of Karnataka, in terms of formulating future policies regarding the continuation of this program and to augment the coverage of the program to students in high school, who are currently excluded from the

[37] Long-term absence refers to whether students are absent for more than a month, in a given academic year.

program. Moreover, since the policy was implemented at scale by Government officials, this study would also have an external validity to other districts in Karnataka and perhaps even other developing countries.

This study is organised as follows. The next section provides a synopsis of the health status of children in low-income countries and the rationale for school-based health programs. This is followed by an overview of school-based health programs in other developing countries. In section 4.3, we provide a background on the formal education system in Karnataka, followed by a discussion on the educational and health status of children in Karnataka. Section 4.3.3 provides a detailed description of the School Health Program implemented in Karnataka. Section 4.4 reviews the related literature, following which; we present the research questions that we seek to address in section 4.5. We provide a detailed description of the data collected and the estimation strategy adopted in Sections 4.6 and 4.7, respectively. Section 4.8 presents the results of this study, followed by robustness checks. The final section concludes.

4.2 Motivation

4.2.1 Health status of children in Developing countries and Rationale for School Health programs:

In this section, we provide an overview of the prevalence of common health issues afflicting school children in developing countries and how it affects school participation and academic performance. Health and nutrition can affect education in many ways. In low-income countries, physical and mental disability can be a major barrier to schooling. Both disease and poor nutrition can prevent children from enrolling in schools, deterring their learning potential and widening the gap in educational outcomes, relative to their healthy peers. Further, in poor settings, parents may disproportionately invest in the education of their children depending on the health of the child, often investing more in healthy children compared to their less-healthy or sick siblings.

The following health problems are especially common among school-aged children in the developing world: malnutrition, micronutrient deficiencies, worm infestations, acute respiratory infections (ARIs), malaria and to a lesser extent, human immunodeficiency virus (HIV), dental caries and visual acuity disorders (Bundy, 2011).[38] Most of the leading causes of illnesses in low-income countries are treatable and preventable with the assistance of adequate resources and access to health care providers, providing children with the potential to attend school and learn. This reinforces the need for school-based health programs in promoting health, child development and educational outcomes (Bundy, 1996; Bundy and Guyatt, 1996).

Malnutrition is an extremely common phenomenon in developing countries. Under-nutrition, manifested as stunting and being underweight, impairs children's mental and physical development, increases susceptibility to infections and can also affect school readiness in terms of cognition. WFP estimates that nearly one in three children suffer from some form of malnutrition. Implementing maternal health and early childhood health interventions would be crucial to combat and reduce the prevalence of both acute and chronic malnutrition. Behrman and Hodinott (2005) state, "Physical growth lost in early years as a consequence of malnutrition is, at best, only partially regained during childhood and adolescence, particularly when children remain in poor environments. Malnutrition, particularly severe malnutrition in early childhood, often leads to deficits in cognitive development. Poorly nourished children tend to start school later, progress through school less rapidly, have poorer academic achievement and perform less well on cognitive achievement tests when older, including into adulthood."

[38] Certain illnesses or diseases are more common among children under the age of 5, relative to school-aged children in developing countries. These include: Measles, rubella, pneumonia, diphtheria, diarrhea, polio, meningitis, encephalitis, croup and cerebral malaria (Jukes, 2006).

Although early childhood or maternal health interventions lay the foundation for a healthy start, the continuation of these nutritional and health interventions to pre-school and school-aged children are also crucial to promote physical and mental development and to inhibit micronutrient deficiencies and susceptibility to infections. As such, both programs are considered complementary and beneficial.

Malnutrition in the form of micronutrient deficiencies is also highly rampant in low-income countries. Micronutrients, both vitamins and minerals are essential in small amounts for proper growth and metabolism. The lack or shortage of micronutrients increases morbidity and mortality and also has negative impacts on other aspects of health, cognitive development and economic development (WFP, 2014). The most common form of micronutrient deficiencies includes iron deficiency anaemia, which is highly endemic in low-income countries. The World Health Organization (WHO) estimates that nearly 40% of pre-school children are anaemic in developing countries. Bundy et al. (2006) reported that more than 50% of school-aged children are estimated to suffer from iron deficiency anaemia. It has been shown that iron deficiency anaemia increases susceptibility to infections and increases the likelihood of experiencing weakness or fatigue (Haas and Brownlie, 2001). Further it has also been linked to the slowing of cognitive and physical growth among children (Lozoff, 2007; Lozoff et al., 2006). Children with iron deficiency score between 1 to 3 standard deviations worse on educational tests and are less likely to attend school (Bundy et. al, 2006).

Other common types of micronutrient deficiencies affecting school children include Vitamin A deficiency and iodine deficiency. Among preschool children, WHO reports that an estimated 250 million children are vitamin A deficient. Whereas, among school-age children, Bundy et al. (2006) highlights that Vitamin A deficiency affects an estimated 85 million children in developing countries. In children, lack of vitamin A causes severe visual impairment and blindness, and significantly increases the risk of severe illness through a weakened immune system. Simple interventions like multiple micronutrient supplements can play a critical role in reversing these deficiencies and would be cost-effective to implement in endemic regions, using schools as an effective delivery mechanism.

Iodine deficiency, another common micronutrient deficit, affects 60 million school children in developing countries and is one of the main causes of impaired cognitive development in children (Bundy et al., 2006). In response, the World Health organisation has recommended the adoption of a simple, effective and inexpensive program in developing countries, namely the salt iodization program. Take-up of iodized salt has been gradual and presently, UNICEF estimates that 66% of households have access to iodized salt. Some countries have made the program especially effective by introducing double fortified salt, i.e. salt fortified with both iodine and iron.

Helminthic or worm infections are extremely common in low-income settings. Other illnesses such as malaria and anaemia are further exacerbated by worm infestations. Further, micronutrients are not properly absorbed in the presence of worm infections. Bundy (1997) estimates that between 25 and 35 percent of school age children are suffering from worm infestations. These Helminthic Infections lead to increased school absenteeism and deprive children of learning on the days they miss school (Miguel and Kremer, 2004). These missed learning opportunities can in turn detrimentally affect student performance and educational attainment. Government and policy makers have started to respond to this issue by implementing mass deworming programs and have recognised schools to be a suitable platform and an effective delivery channel.

ARIs, or upper respiratory tract infections, which include ear infections, rhinitis, sinusitis are extremely common among school-aged children, and are a major cause of school absenteeism. Chronic ear infection following repeated episodes of acute ear infection is common in developing countries, affecting 2 to 6 percent of school children (Simoes et al., 2006).

Children in endemic regions are also at risk of contracting malaria and dengue, which is a major cause for mortality and morbidity in children. The death toll from malaria is atrociously high, killing 3000 children in Africa daily (WHO, 2003). Children who survive an episode of malaria suffer from learning impairments (UNICEF, 2005). Brooker et al. (2000) and Brooker (2009) suggest that malaria accounts for 50% of all absences in schools. Furthermore Bundy (2011) remarks that during the transmission season, even teachers may also be at risk of getting infected by malaria and in some cases, this has even resulted in the closure of schools.

Dental caries or dental decay are not only prevalent among children in developed countries, but are also widespread in developing countries. However, in low-income settings, dental caries remain largely untreated, due to the lack of access to health services. The accompanying pain of untreated dental caries can negatively affect children's school attendance and attention span, whilst also adversely affecting their diet and nutrition.

Another condition that remains largely untreated in poor settings are visual acuity disorders. Bundy et al. (2003) report that about 10% of school age (5-15 years old) children have refraction errors. They further note that almost all refraction errors can be corrected with properly fitted eyeglasses, but that children in low-income settings do not have spectacles or even access to health care providers. This is corroborated by Resnikoff et al. (2008), who report that nearly 12 million school-aged children need glasses but do not have them. They also state that between 90 to 95% of children with impaired vision suffer from myopia. Poor or impaired vision can be extremely disconcerting to young children, which could very likely stymie classroom concentration and effective learning.

As outlined in this section, there is a major cause for concern with regards to the health and nutritional status of children in developing countries. Jukes, Drake and Bundy (2008) show that common illnesses lead to significant deficits in school participation and remark that they have extremely large-scale global effects. In particular, they report an estimated loss of 200 to 524 million years of schooling lost attributable to illness such as stunting, anaemia and worm infections.

This reinforces the role for governments and policy makers to tackle this issue. Schools could function as an effective platform to address these health disorders through quality school health programs. Additionally, these programs could also contribute to welfare packages and social safety nets in low-income countries. There is growing recognition of the importance of these programs in promoting health and hygiene of children in developing countries. These programs have the greatest impact on the most disadvantaged and vulnerable children and can help promote equity in educational outcomes (Jukes, 2006).

Some criticisms of school-based health programs are that school aged children are too old to fully benefit from any potential gains of these programs, given the success of maternal health and early childhood health interventions. The latter types of programs targeted during early childhood are being made a priority in financially constrained economies. Governments and policy makers have come to acknowledge that school-based health programs and early childhood health programs are complementary, rather than competitive.

Jukes (2006) and Bundy (2011) argue in favour of the implementation of school health programs. They note that although micronutrient supplementation and malaria prophalyxis are considered to be especially effective during early childhood and are recommended to be part of maternal health programs, these interventions would also be useful and relevant for school aged children. They argue that there is no evidence of a critical period of intervention, since older children also benefit from these programs, in addition to children below the age of 5. They further state that there is no evidence that these health and nutrition interventions cease to be effective in improving education outcomes for older children.

Furthermore, they also note that deworming, in particular, would be extremely relevant for school-aged children, because worm infestations are extremely prevalent and intense during this age. Additionally, visual acuity disorders emerge during school age and correcting them through school based health programs would be more appropriate, rather than leaving them untreated or correcting it in early adolescence. Dental decay is also more common among school children and very rarely occurs in early childhood. Hygiene education and demonstrating the importance of practicing it regularly, can be taught more effectively by teachers in a school environment. Children at this school age are more impressionable and are malleable enough to practice better hygiene.

School health programs or services available throughout the academic year can also address health and nutritional problems that exhibit seasonal variations, for instance the seasonal transmission of certain diseases/illnesses or the seasonal variation in nutritional dietary intake in a largely agricultural based community. School health programs or community health programs help make health care more accessible and affordable to residents in low-income countries.

It is also worthwhile to point out that there is a large literature that analyses the impact of various educational interventions provided to children in developing countries on student learning and performance. These educational programs include teacher training, student scholarships, teacher incentives, providing free school supplies (for example, text books, stationary, uniforms), computer and instructional technology assisted learning (McEwan, 2015). All these interventions are required to provide quality school education. However, these educational interventions would be partly counterproductive or ineffective if children are sick or hungry. Addressing the health and nutritional status of children should be made a priority, as they serve as the foundation and necessary condition required for universal education, learning and academic progress.

As such, this section has demonstrated the rationales for school based health programs, in view of the poor health status of children in low-income settings. Next, we provide an overview of the school health programs that have been implemented in various developing countries in the last 2 decades in the next section.

4.2.2 Overview of School based Health Programs in Developing Countries

School-based health programs are ubiquitous in high-income countries and most middle-income countries (Bundy et al., 2006). Low-income countries have gradually come to recognize the importance of these programs in ensuring the promotion of good health and have adopted various school based health interventions, tailored to students in developing countries.

School health check-ups or school health clinics are uniquely placed as they remove any barriers that may exist in accessing health services in low income countries, by bringing health care providers to the school premises. Further, these services are offered free of cost, making health care more accessible and encouraging children to seek treatment. Anecdotal evidence from Madagascar and Guinea reveal that parents take full advantage of the school health services offered (Del Rosso and Marek, 1996).

Policy makers have identified schools to be a cost-effective delivery mechanism for the provision of health services. At present, most countries have some form of school-based health programs. These programs, however, are diverse ranging from providing health and hygiene education, micronutrient supplementation, mass deworming and health screening programs- either offered individually or as a more integrated health package. In many developing countries, these school based health programs have commonly been implemented by the respective Government departments in partnership with non-governmental organisations or by international organizations such as World Bank, WHO, UNESCO, UNICEF and UNDP.

The success of these programs are compounded by limited financial resources available, thereby contributing to the difference in the extent of services rendered to the students – implementing only certain components of the comprehensive health program. For instance, in some countries, health programs are being implemented only by disseminating vital information on health, nutrition and hygiene with the goal of preventing diseases through incorporating health education in the school curriculum.

These types of programs have been implemented with assistance from the World Bank in Angola, Ghana, Madagascar, Mali, Zaire and Zambia (Del Rosso and Marek, 1996).

Mass deworming among school-aged children, in particular, has been advocated by the World Health Organization to be implemented in endemic areas in developing countries. Numerous developing countries in Latin America, Africa and south Asia have launched their own national deworming programs in the last decade at the behest of these international agencies. The Kenyan National Deworming program is a notable example, where 3.6 million children were dewormed in 2009, the year of inception of the program (Bundy, 2011). It aims to reach 5 million children by the end of 2016.

A survey conducted in 2000, revealed that most of the school based health policies were confined to providing health education and in some cases by incorporating it in the school syllabus. However, by 2007, the activities of school health programs had expanded and included a more comprehensive and integrated policy, combining various health interventions (Bundy, 2011). We provide some examples of the school health programs that are currently implemented below.

Health and hygiene education is taken one step further by the National Hand-washing initiative in Peru (Centre for Global Development, 2007; World Bank Report, 2010; Glassman and Temin, 2016). The program introduced hand-washing stations installed at schools combined with teacher training initiatives to ensure that hygiene of students was maintained. The Kenyan Ministry of Education took action to provide safe and clean drinking water to schools in western Kenya, through the provision of water dispensers with chlorine disinfectants (Ahuja, Kremer & Zwane, 2010). Oral health education and free dental services, which include annual dental check-ups and treatment, are offered to primary school children in Hong Kong.

A unique program in Malawi offered training to schoolteachers to detect and treat malaria among pupils. The program was implemented in partnership with NGOs, whereby sick children were treated with antimalarial drugs administered by trained teachers. The program significantly reduced the mortality rate of school children.

Integrated school health programs that combine health education with micronutrient supplementation, deworming and health screenings followed by prompt treatment, have been emerging and are gaining popularity. Specific examples include the School Health Promotion program (SHPP) in Sri Lanka and the School health Program in Bangladesh, which was introduced in 2007 and 2011, respectively (Bundy, 2011; UNICEF Report, 2014). In addition to the health services listed above, the SHPP also ensures clean drinking water and sanitation facilities.

Similarly, a national school-based Health program in Guinea comprises of an iron and iodine supplementation program, deworming program, accompanied by education in health and hygiene (Del Rosso and Marek, 1996). The Government of Burkina Faso in collaboration with UNICEF and with assistance from the World Bank offer the following health services to school-children: Vitamin A and iodine supplementation, deworming, and incorporating health and nutrition education in the curriculum (Bundy et al., 2006).

The 'Fit for School' program presently implemented by the Department of Education in the Philippines, has been lauded for its inclusion of daily supervised hand-washing and tooth-brushing activities as a distinct part of the program. In addition to the provision of health education, particularly focusing on regular and dental hygiene, the program also includes a bi-annual deworming component. Table 4.1 provides a synopsis of the school based health services that are currently provided to children in selected developing countries.

The coverage of these school-based health programs in some low-income countries is also limited to certain geographic areas due to budget constraints. Moreover, the effectiveness of these programs is limited by the lack of information on the prevalence and intensity of certain diseases and disorders in certain regions and often do not reach children most in need.

Various developing countries have started taking the next steps to survey and identify endemic areas and to introduce comprehensive school-based health programs or to increase the scope of existing programs. The programs proposed to be implemented in Uganda and Rwanda is projected to include malaria treatment and prevention, iron supplementation and health screening of the students, together with deworming and health education (World Bank Report, 2014; WHO Report, 2014). Endemic countries in Africa have also paid special attention to the benefits of distributing bed-nets sprayed with insecticides in order to combat malaria, following a successful pilot intervention in Kenya (WHO Report, 2007). The government of Guyana is engaged in increasing the reach of the school medical inspections program to the remote areas of the country (Bundy, 2011).

In sum, many developing countries have some form of school health program. The components of these programs and the coverage vary due to financial constraints. Governments and policy makers have come to recognise the importance of integrated school health programs and have started to make it a priority. As a consequence, the number of countries offering comprehensive school health services and the coverage is steadily rising. Despite the increase in coverage, the evidence on the effectiveness of these programs is scarce (discussed in section 4.4).

In the next section, we provide details of the School Health Program implemented in Karnataka, India. This is preceded by a discussion of the formal education system in Karnataka and the educational and health status of children.

4.3 Institutional setting and background

4.3.1 Schooling in Karnataka

In this section, we provide a detailed background on the formal education system in Karnataka state, India. Formal Primary education consists of 7 years of schooling. Grades 1 to 5 are classified as Lower Primary School, while grades 6 and 7 are classified as Upper primary school.

Significant progress has been made in attaining universal primary education in Karnataka in the last decade. According to the District Information system for Education (DISE), the net enrolment rates in Lower primary school have steadily increased from 83.97% in 2005 to 94.44% in 2014.[39] Additionally, there has also been a sharp increase in net enrolment rates (NER) in Upper primary schools. DISE reported net enrolment rates of 48.46% in 2005 for upper primary schools, while the corresponding figure was 85.02% in 2014.

The state of Karnataka also fares moderately better in terms of the NER in primary school, relative to the nation-wide average. According to DISE, the all-India average NER in 2014 was 88.08% for lower primary school and 70.20% for upper primary school.

Correspondingly, the grade repetition rates and drop out rates in primary schools in Karnataka have also declined in the last decade. The average grade repetition rate in primary schools in 2006, at the time of program introduction was 1.80%. This number has declined to 0.76% in 2014. The average dropout rates from Primary school have also gone down from 6.80% in 2006 to 2.03% in 2014. The transition rate from lower Primary to upper primary school was 96.20% in 2014.

In spite of the great strides made towards achieving universal primary education, student-learning levels have remained consistently low in Karnataka. According to the Annual status of education report (ASER) conducted in 2006, only 56.1% of children in Grades 3 to 5 in Karnataka could read a Grade 1 level text, relative to the national average of 65.9%. In addition to the low reading levels, arithmetic levels have also been below par. Only 45.9% of pupils in Grades 3-5 could solve an arithmetic problem involving subtraction or division, compared to the national average of 65.1%.

[39] Net enrolment rates are defined as the ratio of the number of children of primary school age who are enrolled in primary education to the total population of children of primary school age.

Further, there are significant disparities in reading and arithmetic levels between students in Public and private schools. 44.5% of Grade 4 students in Public schools could solve at least a subtraction problem, as opposed to 58.6% of students in Private schools. In terms of reading levels, 55.3% of Public school students in Grade 4 could read a Grade 1 level text, compared to 63.0% of private school students (ASER, 2013).

Public schools and a growing number of private schools serve the population of students in Karnataka. In 2006, at the time of program introduction, 81.0% of the schools were managed by the Department of Education, Government of Karnataka. Though, there has been a steady increase in the number of private schools in Karnataka since 2006. In 2014, 25.9% of the schools were privately owned and managed.

Approximately 50% of the public primary schools are Lower primary schools (Grades 1-5). The remaining consists of schools containing both lower and upper primary schools (Grades 1-7) combined. Students in lower primary schools are typically provided with a transfer certificate, upon successfully completing Grade 5, in order to seek admission in upper primary schools. Similarly, students who complete Grade 7 are also provided with a transfer certificate to enable them to obtain admission in secondary schools.

In the remainder of this section, we provide a comprehensive overview of Government schools in Karnataka. We focus on the former and disregard private schools in the discussion, as the School Health Program was implemented exclusively in public schools in the state.

Public schools are free, and students are typically guaranteed admission to at least one public school in their region/neighborhood of residence. Although these types of schools do not explicitly charge tuition fees, some schools occasionally charge other fees such as Library fees, development fees, examination fees and so on. The government schools also have strict quotas imposed with regards to the admission of children from poor socio-economic and disadvantaged backgrounds. In particular, roughly more than half of the places/seats are reserved for pupils belonging to the Scheduled caste (SC), Scheduled Tribe (ST) groups and Other Backward classes.

The curriculum in Government Primary schools is set by the Department of Public instruction, Government of Karnataka. There is uniformity in the curriculum across all schools managed by the Department of Education. The schools also follow the same format and structure in terms of the academic year, subjects taught and tests/exams administered. Further, all public schools in the state are mandatorily subject to periodic inspections by officials from the Department of Public Instruction. However, there is a small distinction between the government schools in terms of the Medium of instruction. In majority of the schools, the medium of instruction is the State's official Language, Kannada. More specifically, in 89.56% of the public schools, the Medium of instruction is Kannada. Whereas, in 7.64% of the public schools, the language of instruction is Urdu. The medium of instruction in the remaining schools include languages from other neighbouring states in India, namely, Tamil, Telugu and Marathi.

The core subjects taught are the same across all public schools. The main subjects taught in Grades 1-4 include Mathematics, Kannada and Environmental studies.[40] While, students in Grades 5, 6 and 7 are taught the following 5 compulsory subjects: Kannada, English, Mathematics, Science and Social science. In some public schools, students in Grades 5-7 are also offered a Third language, Hindi (national language), depending on the availability of teachers to teach Hindi. Students in grades 5, 6 and 7 are examined on the above-mentioned five core subjects through both Mid-term tests and Annual final examinations. However, it must be mentioned that these tests and exams are school-level examinations and not standardised state level examinations. However, the format, structure, syllabus and educational content of the examinations are the same across all Public

[40] In schools where the language of instruction is Urdu, students take Urdu as the first language instead of Kannada.

schools. Standardised state level examinations are only administered in secondary school, specifically to Grade 10 and 12 students.[41]

With regards to the school administration and staff, teachers and principals are appointed in a uniform way across all schools managed by the Department of Education. Certain quotas are imposed with regards to the appointment of teachers from disadvantaged groups. In particular, according to the 7th All India Education survey conducted in 2002, roughly 86% of the full time teachers working in public schools in Karnataka belonged to the scheduled caste, scheduled tribe or other backward classes social group (Seventh All India School Education survey Report, 2006). Majority of the teachers appointed possess Professional Teaching qualifications and are also provided with in-service training rendered by the Government. According to DISE, 98% of the regular and contract teachers hold professional teaching qualifications. Thus, disparities in faculty quality across schools are negligible.

Almost all government schools receive School Development Grants and Teacher Development grants sanctioned by the State government in order to improve the schools infrastructure and to ensure that the teachers receive adequate in-service training and preparation. The discrepancies in school facilities available are also quite modest across schools.

In the next section, we offer a description of the health status of children in Karnataka.

4.3.2 Health status of children in Karnataka

According to the third National Family Health survey (NFHS 3) conducted in 2005-2006, 44% of children in Karnataka under age five are stunted, or too short for their age, which is driven by chronic under-nutrition. Further, 38% are underweight, an indicator of both chronic and acute under-nutrition (National Family Health survey report, 2007). These figures are slightly

[41] Students in Grade 7 were also required to sit Standardized state level examinations. However, this was abolished in Karnataka in 2002.

lower than the national average, where 48% and 43% are stunted and underweight for their age, respectively.

In addition to malnutrition, Iron deficiency Anaemia is a major health concern in Karnataka, especially among women and children. According to NFHS 3, among children between the ages of 6 and 59 months, the great majority—71%—are anaemic, similar to the national average. This includes 29% who are mildly anaemic, 39% who are moderately anaemic, and 3% who suffer from severe anaemia.

It must be mentioned that no state-wide survey exists measuring the health status of school-aged children, representative at the state or district level. The only exception is the National Family Health survey, which collects information on the health indicators of children below the age of 5. Some plausible reasons include the organisational and logistical difficulty in measuring health status of children and the costs involved, further exacerbated by the blood tests that need to be administered and analysed to accurately detect certain health deficiencies. However, clinical studies from the medical literature, discussed below, have partially helped fill the gap.

Various studies from the medical literature have identified the most common ailments prevailing among school-aged children in Karnataka. The findings reveal that these ailments typically include: malnutrition, worm infestation, anaemia, vitamin A deficiency, iodine deficiency, dental caries, upper respiratory tract infections and refractive error. These studies have been carried out by Doctors who clinically examine school children and if relevant, have also administered and analysed blood tests. The prevalence of these ailments/infirmities depends on the setting, particularly noting disparities between urban and rural areas.

These studies further note gender disparities, regional and district-level disparities in the prevalence of these illnesses as well as disparities between students attending government and private schools (Kamath et al., 2013). We briefly review some of these studies below to offer a sense of the prevalence and magnitude of the common illnesses afflicting school children in the state.

A number of studies have sought to determine the most common health problems affecting school-aged children in Karnataka. Medical examination of children from one district revealed that 37.5% were undernourished, 16.3% of the children had undetected refractive error, while 22.9% of the children suffered from dental caries (Aroor et al., 2014). A related study by Nigudgi et al. (2012) found that besides undernourishment, 10% of the children were found to be anaemic, while 10.9% were diagnosed with Bitot spots, a sign of Vitamin A deficiency. In the setting of urban schools, a similar study conducted by Kulkarni (2014) revealed that among students that were medically examined, 11.5% had Anaemia, 24.9% had Dental Caries and 1.9% had Refractory Error.

In terms of the prevalence of worm infestations, a clinical study conducted by Kumar et. al. (2003) detected an extremely high rate of worm infestations of 71.73% from a sample of girls aged between 6 and 10 years old from one district in Karnataka. A recent study by Reddy & Basha (2013), finds a lower prevalence rate of intestinal parasites of 19.8% from 2 districts in Karnataka. They also noted a significant difference in prevalence rates between urban and rural schools.

Turning to micronutrient deficiencies, Ahmed et al. (2014) analyse the prevalence of iodine deficiency in two districts in Karnataka from a sample of 10,082 children aged between 6 and 12 years. They concluded that iodine deficiency disorders was endemic in both districts through the manifestation of goitre, with prevalence rates ranging from 8% to 19%.

Thus to sum up, poor health and nutrition appears to be rampant phenomena adversely affecting children in Karnataka. The common ailments typically afflicting children in Karnataka are identical to those found in other developing countries, though with varying prevalence rates. This reinforces the need for school-based health programs to improve the health and nutritional status of children. The following section contains a detailed discussion of the School Health program implemented by the Government of Karnataka.

4.3.3 The School Health Program

In view of the deplorable health and nutritional status of school children in Karnataka, the Government sought to address this issue by launching a School Health Program called "Suvarna Arogya Chaitanya program" in 2006. The program implemented by the Government of Karnataka is a joint venture by both the Department of Education and the Department of Health and Family Welfare. The program offers comprehensive health care services to students enrolled in public primary schools, free of cost. The main objectives of the program are to provide preventative, promotive and curative health services (Department of Public Instruction, Government of Karnataka).

The program is an integrated health package offered to students, comprising of three main components: First, micronutrient supplementation and mass deworming. Second, regular health screenings by Doctors on the school premises and third, provision of Health education and awareness. These are described in more detail below.

First, all students receive periodic micronutrient supplements and deworming medicines as part of the scheme. More specifically, each student receives the following:

(i) Vitamin A tablets: Each student receives one tablet (dosage of 200,000 IU) every six months. So, students are provided with a total of two tablets per academic year.
(ii) Iron and Folic acid tablets: Students are provided with three tablets per week for a total of thirty-six weeks in an academic year. Each tablet contains a dosage of 20-milligrams of Iron and Folic acid.
(iii) De-worming Medication: Each child is provided with Albendazole tablets (400 milligrams) once in six months, or twice in an academic year.[42]

[42] The dosage of deworming medication (Albendazole tablets – 400 milligrams) is in line with WHO recommendations for school children (WHO report, 2013). The dosage of Vitamin A (200,000 IU) tablets are the WHO recommended dosage for children aged between 1 and 5 years. WHO recommends the intermittent provision of 45mg elemental iron for school aged children (aged 5-12) and 25mg of elemental iron for pre-school children (aged 2-5).

Second, the program mandates that all students in public schools be subject to periodic medical check-ups to be conducted by Doctors from Government hospitals or public Primary health centres, on schools grounds.

At these Health checks, Doctors medically examine each student and also inquire if the child is suffering from any illness or disease. Upon diagnosing an illness/ailment, Doctors either treat children on the spot by providing them with a prescription for free medicines or they make referrals to specialists in local hospitals, where the child is provided with free treatment. In case of detection of a serious medical ailment, parents of the child in question are notified and are then treated in hospitals free of cost.

Some salient features and objectives of the Health check-ups conducted at the schools include:

1. The prevention of diseases;
2. Early diagnosis, treatment and follow up of defects;
3. Imbibing Health consciousness and education among children

Since its implementation, regular health screenings are carried out throughout the duration of primary school, for each student enrolled. The health checks are ordinarily held once a year on school working days. The health checks usually take place at the start of the academic year. The schoolteachers typically supervise on the day of the health camps and ensure that the program is implemented smoothly. The parents of the eligible children are notified about the health screening days in advance by Accredited social health activists (ASHA) Health workers and the respective schoolteachers.[43]

It must be noted that blood tests are not part of the health check-ups, due to the expenses involved in analysing blood samples and the organisational and logistical difficulties involved, in addition to the ethical approval and consent required from parents or guardians. Further, blood tests are not

[43] Accredited social health activists or ASHA workers are community health workers appointed by the Ministry of Health and Family welfare, as part of the National rural Health mission. Further information available at http://nrhm.gov.in/communitisation/asha/about-asha.html

warranted to be included in the program by the Government, perhaps because most students do not urgently require them.

In the case of a serious medical illness, students are referred to specialists in local hospitals and starting from 2012, the transportation costs are borne by the Government.[44] At the hospitals, the consultation fees, cost of analysing blood and urine tests or x-rays and the cost of surgeries are also borne by the Government.

Third, Health education and awareness are an important part of the program. Doctors and teachers emphasize the importance of good hygiene, cleanliness and sanitation at the Health camps. They offer useful information on a range of health issues such as maintaining a balanced diet, importance of nutrition, regular and dental hygiene and information on disease prevention.

Lastly, students participating in the program receive a Health card, where the Doctors record each students' height, weight and document any diagnosis made and the treatments or referrals provided. These health cards detail each student's health status throughout primary school. The health cards enable children to seek free treatment at local hospitals, even during school holidays and vacation periods.

The School Health program was phased in sequentially across all Public primary schools in Karnataka, starting from 2006. The coverage has been steadily increasing since its inception (see Table 4.2). By 2012, almost all government schools in the state have been covered by the program.

The funds for the program are sanctioned and financed by the Ministry of Human Resource Development and the Ministry of Health and Family welfare. The Doctors, conducting the health screenings of the students are also financially remunerated by the Government for their services. During the 2013-14 academic year, 3,186,441 children were medically

[44] The transportation costs refer to the costs of transporting children and their parents from their respective primary schools to Government hospitals or Public Primary Health centers. The transportation costs also include the transport costs incurred by Doctors in traveling to the Public schools for the Health checks from their respective hospitals or primary health centres.

examined, with 1744 receiving surgery treatments (Government of Karnataka, 2016).

In the next section, we review the related literature that studies the impact of school-based health interventions on educational and health outcomes.

4.4 Literature Review

Extensive research has been conducted on the impact of specific health interventions on schooling and health outcomes of children in developing countries. They have systematically found a positive relationship between health and educational status. A growing research literature has sought to establish a causal link between health and educational outcomes, by adopting an experimental design to study the impact of specific health interventions.

The health interventions studied in previous work have been administered at different times, ranging from maternal and early childhood health interventions to those implemented in pre-schools and to school aged children. The health interventions also differ in terms of the treatment, medication or supplements provided, with varying intensity and frequency. It has been well established that the baseline health status of children are pertinent and the greatest improvements are seen in malnourished children, with negligible changes in adequately healthy children. Some evidence also exists on the effects of more established health reforms such as health insurance policies. Recent work has also assessed the impact of conditional cash transfers that are commonly implemented in conjunction with health and educational programs in developing countries.

In this section, we focus on reviewing the studies that evaluate the impact of school-based health interventions on educational and health outcomes.

Considerable work has been carried out on identifying the educational impacts of mass deworming among school children. Earlier studies by Kvalsig, Cooppan and Connolly (1991) and Nokes et al. (1992) find some impacts of deworming on cognitive ability, but do not find statistically significant effects on academic performance of students. Dickson et al. (2000) review the literature on the schooling outcomes of deworming and conclude that the studies do not demonstrate convincing evidence of the educational benefits of mass deworming.

The main drawbacks in the earlier studies were that the treatment was administered at the pupil level within schools rather than at the school level. These studies did not take into account the intra-school positive externalities generated by the program, which could have also influenced the health status of placebo groups, thereby underestimating the program effects. Further, many of the earlier studies suffered from student attrition.

Miguel and Kremer (2004) find evidence of substantive gains in school participation rates in Kenya as a result of a randomised school-deworming program. They compare schools that received the program earlier relative to those that had not yet been phased in to the program. They explicitly account for the externality effects and find evidence of large, positive and statistically significant externalities. They estimate the increment in school participation along with the externality benefits to be 8.5 percentage points.

Surprisingly enough, they do not find any immediate effects of the program on test scores of the students. They partially reconcile this finding by reporting that the intervention led to crowded classrooms, which could have worked against any potential positive effects of the program on student learning and achievement (Glewwe and Miguel, 2008).

The long run follow up evaluation of the deworming program in Kenya by Baird et al. (2014) find that the program increased the pass rates of the national primary school exit exam for girls by 25%. They argue that these results stem from the increased learning due to the increased school participation rather than any potential gains in cognitive function, as the children were too old when they received the intervention. A related study by Croke (2014) examines the long run follow up of a randomized deworming program in Uganda on academic test scores. They find evidence that children in treated villages have significantly higher test scores relative to the control villages and the size of effects are in the range of 0.2-0.4 standard deviations.

Turning to studies that evaluate the impact of micronutrient supplementation, Seshadri and Gopaldas (1989) find that iron supplementation in an experimental setting led to improvements in cognitive function of pre-school and school aged children in India. These results echo the findings by Soemantri, Pollitt and Kim (1989) and Soewondo, Husaini and Pollitt (1989). Nokes, van den Bosch, and Bundy (1998) survey a number of experimental studies and conclude that iron supplementation had positive impacts on cognitive and motor development, as well as on educational achievement of anaemic children.

A later study by Bobonis, Miguel, and Sharma (2004) find that a randomized controlled trial of iron supplementation in combination with deworming treatment, led to a significant decrease in school absenteeism, by one-fifth, among pre-school children in Delhi, India. They also find significant increases in weight-for-age and weight-for-height anthropometric measures.

Zinc supplementation along with other micronutrients randomly administered for a period of 10 weeks, led to significant improvements in motor skills, attention and other non-cognitive skills among children aged between 6 and 9, from low-income families in China (Sandstead et al., 1998). However, Cavan et al. (1993) find that a randomized trial of zinc supplementation alone did not lead to any change in mental concentration or short-term memory of Guatemalan children. Similar findings are reported by Gogia and Sachdev (2012) from reviewing the literature on randomized experiments involving zinc supplementation.

Bautista et al. (1982) find that iodine supplementation, randomly implemented on a double-blind basis in a largely endemic area in Bolivia led to an increase in iodine stores among the treated children, accompanied by goiter reduction and increase in overall IQ scores. Studies from the nutrition literature have noted that mild to moderate iodine deficiency can easily be reversed, resulting in an improvement in cognition of school children (Gordon et al., 2009; Zimmerman et al., 2003).

A randomized experiment of providing children in rural china with chewable vitamins with iron led to an increase in standardized math test scores and moreover, increased hemoglobin levels (Kleiman-Weiner et al., 2013). Nelson (1992) also provides suggestive evidence that vitamin-mineral supplementation in third world countries, among school children with well-characterized nutritional deficiencies can translate into consistent and significant improvements in performance on intelligence tests.

Supplementing children with multiple micronutrients, namely Vitamin A, iron and folic acid and zinc using an experimental design have been shown to improve attention span in children aged between 6 and 15 in India (Vazir et al., 2006). Evidence from the clinical literature also indicates that multiple-micronutrients are more effective than administering a single micronutrient, given the mutually beneficial interactions between them. Additionally, ingesting a single micronutrient may also cause the risk of nutritional imbalance.

There is growing evidence that preventive measures adopted to combat malaria could positively affect school participation and cognition. Shiff et al. (1996) report that the use of insecticide treated bed nets not only reduced the prevalence of malaria, but also increased school attendance in Tanzania. Jukes et al. (2006) find evidence of higher educational attainment as a result of children receiving malaria prophylaxis during early childhood in Gambia.

An evaluation of a randomised trial of intermittent preventative treatment (IPT) of Malaria in primary schools in Kenya by Clarke et al. (2008) has demonstrated that the intervention helped reduce anaemia and increase cognitive ability among the treated group relative to the placebo group. They do not, however, find any evidence that the intervention affected educational achievement. Despite this finding, they state that the IPT program would be a valuable addition to school health programs with the added benefit of the practicality and cost-effectiveness of the program.

On the contrary, Fernando et al. (2006) finds that experimentally administering antimalarial pills in Sri Lanka, increased school attendance by 3.4%, in addition to increasing test scores in reading and mathematics. A later study by Fernando et al. (2010) survey the literature and conclude that clinical trials offering malaria prophylaxis resulted in improvements in cognitive function and school performance of children, relative to the placebo group.

With regards to studies that evaluate the effects of visual impairment in children, there is emerging causal evidence that poor vision, in particular, can have an adverse effect on children's academic performance. A recent study by Glewwe, Park and Zhao (2014) study the impact of providing free eyeglasses to primary school students in an experimental setting in Western China. Their findings indicate that students with poor vision, who wore spectacles for one academic year, benefitted from an increase in test scores, ranging from 0.16 to 0.41 standard deviations.

Glewwe, West and Lee (2014) document similar findings in a more developed setting of elementary schools in three Florida districts. In two of the three counties, provision of free vision exams and eyeglasses led to a significant increase in student performance in Math and reading for grade 5 students. The magnitude of the program impacts range from 0.07 to 0.16 standard deviations of the students test scores.

To conclude, evidence from the related literature have revealed consistent positive educational and health benefits of various school-based health interventions, particularly deworming, provision of eye-glasses to visually impaired children, micronutrient supplementation consisting on iron, iodine, vitamin A and zinc, in addition to antimalarial treatment in endemic regions. The greatest gains accrue to those who are malnourished or sick at the outset. The positive effects of these programs have lent to the growing recognition of the importance of school-based health programs. These programs help poor children better realize their potential and to fully take advantage of the educational opportunities afforded to them (Bundy, 2011).

This paper seeks to add to the existing literature that studies the impact of school health interventions on schooling outcomes. Most of the previous studies discussed above, look at a specific health intervention in schools. This paper is distinct from the other studies as we evaluate a comprehensive health program that combines a variety of health interventions into an all-inclusive program. The program studied in this paper is also unique as it includes periodic Doctor visits to the schools. There is very little evidence on the effectiveness of this type of intervention on educational and health outcomes. Moreover, the program differs from the other interventions as students' health is monitored at regular intervals throughout the duration of primary school through the Health checks. On the other hand, the health interventions in previous studies have been short-term interventions and have largely been experimental in nature. This study provides evidence under real world settings, since the program was implemented by government officials, with extensive coverage. This is novel from an academic point of view, and it is crucial from a policy perspective.

Further, health and nutrition problems in children are inextricably linked with each other.[45] That is, health and nutritional problems in children often interact with one another and do not occur in isolation. For instance, micronutrients are not effectively absorbed in the presence of worm infections. A specific health intervention that offers only micronutrient supplements, but not deworming medication would not be very effective. As such, specific health interventions only address one element of the wider problem and therefore, only have a partial effect on educational and health outcomes, relative to integrated health programs. In view of this, comprehensive quality health programs would potentially be more effective and may yield larger estimated improvements in children's educational and health status.

[45] For instance, iron deficiency anemia is exacerbated by both worm infestations and malaria. Another example is that HIV weakens the immune system, making children more susceptible to common respiratory infections or worm infestations.

4.5 Research Questions

Given the systematic evidence concerning the strong positive associations between health and education, the School Health program implemented in India provides a unique opportunity to shed some light on the causal effect of the health related interventions on educational outcomes.

The primary objective of this paper is to evaluate the impact of the School Health program on students' educational outcomes, focusing on school participation and academic achievement, in addition to their health outcomes. In particular, we intend to examine the causal impact of the program on students' primary school participation, measured by attendance and exam take-up rates. We are also interested in estimating the program's impact on academic performance, by using the test scores of the students in the core subjects of study.

Turning to the health outcomes, we seek to identify whether the program was successful in improving the health status of children. We therefore propose to examine the program effect on standard anthropometric indicators (height-for-age and weight-for-age z scores).

The key channel through which the School Health program could increase attendance is by reducing the absences resulting from student illness. We would also expect that the program would lead to improved pupil achievement by increasing time spent in school as a result of improved attendance. Furthermore, this improved health resulting from the program can in turn boost classroom concentration and attentiveness. As a result, students would be more alert and would be in a better position to absorb and understand the material being taught by the teachers relative to those suffering from an ailment.

Additionally, the free provision of health services to children may increase resources available to their respective families (Glewwe and Miguel, 2008). These additional resources, which would have been used on health care in the absence of the program might be directed towards improving the children's dietary intake and nutrition, or may be invested in improving the child's educational status through remedial education or tutoring or through the provision of school supplies. These additional resources could also potentially be invested in improving the home environment of the children. This is plausibly another mechanism by which the program could influence children's health and educational status.

Another potential channel through which the program could improve student's academic performance and health outcomes is through spillover effects (De Heer et al., 2011; Miguel and Kremer, 2004). The improved health generated by the program could in turn result in children facing healthier peers in their respective classrooms, schools and neighbourhoods. As such, following the program introduction, children are less likely to be susceptible to infection from their peers. Teachers may also be healthier as they are exposed to a healthy school environment as a result of the program. This in turn could positively affect their productivity at school and could potentially affect students' performance.

On the contrary, we might expect the program to have no effect or even possibly negative effects on educational outcomes if the program led to crowded classrooms from increased enrolment or if the program disrupted the school day and displaced teaching time. This may certainly be a possibility in poorly organized schools where teachers are involved in administering the program, in addition to their daily teaching duties.[46] Moreover, in larger schools, where there are more than 500 students studying on average, it is very likely that many students would not have the opportunity to be screened thoroughly at the health checks due to the limited number of Doctors available.

It could be argued that health maybe impaired by poor nutrition. This is not so much a concern in the current context as all the students included in the analysis are enrolled in Government schools and have been in receipt of cooked Mid-day meals since its implementation in 2002 in Karnataka. The

[46] Teachers may be engaged in clerical work of filing and submitting reports to the Government in relation to the program. They may also be involved in the procurement and distribution of the micronutrient supplements and deworming medicines to the students.

scheme mandates the provision of "cooked mid day meal with 300 calories and 8-12 grams of protein to all children studying in classes I – V in Government and aided schools" (Government of India, 2004).

As such, the complementary interactions between health and nutrition, could be another potential channel through which the program could improve students' educational and health outcomes. For instance, treating children for worm infections with deworming treatment could not only reduce the incidence of helminthic infections, but could also help in increasing the absorption of iron, vitamins and other micronutrients. Thus, the interaction between the nutritional channel and the health channel could potentially be another mechanism through which the Mid-day meals program and the School Health Program lead to positive program effects on health and educational outcomes.

Lastly, the baseline health status of the children also plays an important role in determining the impact of the program on health and educational outcomes. We would expect significant improvements in infirm/ailing children as a result of the program, while no improvements may be seen in the outcomes of adequately healthy children.

As such, this paper contributes to the research literature that evaluates the effect of various school-based health interventions on educational and health outcomes. It is crucial from a policy perspective to understand the barriers that households and governments face in low-income countries in investing in health and how these barriers can be overcome, and to assess the impacts of the subsequent health gains (Dupas and Miguel, 2016). This paper sheds some light on the effectiveness of a school health program in India on educational and health outcomes.

The results from this paper would be particularly relevant to the Government if in fact, the program was successful in improving attendance, academic test scores and health outcomes. On the other hand, if the program had limited success in improving scholastic performance, this would motivate future policy to revamp and modify the existing program. Thus, this study serves to act as a crucial component of policy evaluation for the

Government of Karnataka. The outcomes from our analysis would be particularly relevant for policy makers in terms of formulating future policies regarding the continuation of this program and to augment the coverage of the program in other states in India.

While this project is limited to two districts in Karnataka state, we expect that the results would have an external validity to other districts and perhaps even other states in India and perhaps, other developing countries. Especially since, the program was implemented at scale by government officials, and not in an experimental setting.

4.6 Data Collection

We analyse the impact of the School Health program using administrative data on students' academic records and health records that have been collected from 50 Government primary schools in Karnataka, India. All schools in our study are managed by the Department of Education, Government of Karnataka, India.[47] The students' academic and health records are maintained by the school administration and were collected directly from the school archives.[48]

The data collection took place from schools located in both urban and rural areas in Karnataka. More specifically, the data were obtained from two districts in Karnataka, namely Bangalore Urban district and Bangalore Rural district. This is depicted in Figure 4.1. Within each district, certain blocks

[47] We exclude Corporation schools, private aided and private unaided schools from our analysis and only focus on Government schools managed by the Department of Education. We do so because only the latter type of school consistently implemented the School Health program. Furthermore, the syllabus widely varies between public and private schools.

[48] At the primary school level, all student records are available directly from the school archives and are not centrally available at the Department of Education. It must be noted that these administrative records, namely the health records and the academic records of students that were collected from the Government schools are maintained as a hard copy, generally handwritten in the school's medium of instruction. Consequently, these records were digitised to create a unique dataset, compiling data from 50 primary schools consisting of comprehensive accounts of students' academic performance, attendance and health outcomes.

and clusters were chosen.[49] In Bangalore Urban district, the administrative Blocks selected were South zone 2 and 3. Similarly, in the rural district, Doddaballapura Block was picked. Schools were sampled randomly from within a given geographic area (i.e. within each block).[50] A map illustrating the schools included in the study is provided in Figure 4.2. Our sample consists of only primary schools. We exclude secondary schools and high schools as the School health program is predominantly targeted at primary school students.

In addition to the data collection described above, this paper also uses existing data sources, specifically the District Information system for Education (DISE), which is a school database, containing information on various school-level characteristics for the relevant schools in the sample.

In the following section, we describe in more detail the academic records collected, followed by the description of health records collected and lastly, the DISE data used.

4.6.1 Students' academic Records

We primarily collected the academic records for 5th, 6th and 7th grade students, from each school (students aged between 10 and 12 years). We were able to obtain this data for a period of 5 academic years, starting from 2003-2004 up to 2007-2008. These academic records contain detailed information on academic performance measures and school participation indicators. We elaborate on this below.

It must be noted that we focus on 5th, 6th and 7th grade students, as test scores data are unavailable for students studying in grades 1 to 4 in certain academic years. These latter students are evaluated on the basis of certain core competencies and if fulfilled, the teachers record that the student has

[49] Each district is administratively divided into blocks. The administrative subdivisions of Blocks are clusters and clusters are split into villages. Blocks and clusters were chosen based on Government consent to access the administrative data from the public primary schools.

[50] It must be mentioned that Headmasters in a few schools did not cooperate and we were unable to collect data from these schools.

met all requirements in their respective student academic registers. As such, the academic performance measures for students in Grades 1 to 4 are not comparable across schools. Thus, we limit our attention to students in Grades 5 to 7.

With regards to the pupils' academic performance, we collected data on students' test scores in each of the 5 core subjects that they were examined on. The 5 subjects were: Mathematics, Science, Social science, First language and English. The first language corresponds to the medium of instruction in the school. In majority of the cases, the first language is the State's official language – Kannada. We have also obtained data from schools where the medium of instruction is different from the state's official language. This is done, so as to get a representative sample of Government schools in the state of Karnataka. So, our sample also contains government schools where the medium of instruction is Urdu, Tamil and Telugu. It must be noted that the test scores collected correspond to test scores in the final exams held at the end of the academic year.

It is also worth mentioning that this administrative data are not centrally available at the Department of Education as these test scores correspond to school level exam results and not state level exams. As such, this data are only available in the school archives under the purview of the School headmaster who maintains them. However, as mentioned in section 4.2.1, the syllabus, structure and content of the tests administered are similar across all public schools. Furthermore, the tests administered and the students' academic registers are periodically inspected by officials from the Department of Public Instruction, Government of Karnataka.

In addition to the test scores data collected, details on each student's final performance was obtained. A student's final performance indicates whether they were promoted to the next grade or if they have failed and been retained. The exam take-up rate is also made available in the students' academic records.[51]

[51] The exam take-up variable is measured as a binary variable, indicating whether the student was present and sat the exam, for each of the 5 core subjects.

Turning to the school participation indicators, information on annual attendance of each student has also been collected along with the number of school working days in an academic year. Annual attendance indicates the total number of days the student was present in school in a given academic year. The students' records also contain information on whether the student has been long-term absent i.e. whether the student has been absent for a period of more than one month in a given academic year. We also observe whether the student has left the school either because they have transferred to another school or because they moved to a different city/district.

Other student level characteristics obtained from each school include gender, caste and religion of each student. Information on class size is also observed. It must be pointed out that information on a student's family background such as family income, parent's education, number of siblings, educational status of siblings and area of residence are not recorded by the school and as such, we don't observe this information. Additionally, we were unable to obtain any information on individual teacher characteristics, due to the sensitive nature of the data. We do however have information on aggregate teacher characteristics from DISE, as discussed in section 4.6.3.

4.6.2 Health records

In addition to students' academic records, we were also able to access students' health records. These health records contain detailed information of the health status of each student enrolled in a given school in an academic year. More specifically, we observe the height, weight and age of each student. Each student's height and weight were measured on the day of the health check-up. The Health registers maintained at the schools also indicate whether the student was absent on the day of the health check-up. So, we also observe attendance at these school health screenings.

From the health records, we are able to compute the anthropometric indicators of students, namely height-for-age and weight-for-age z scores. Further, from the height and weight measures recorded, we can also compute body mass index. We use these anthropometric indicators constructed as outcome variables in the empirical analysis, discussed in more detail in the next section (section 4.7).

It is important to mention that the Health records were only maintained once the School Health program was launched and as such, we do not observe the health status of students in the pre-program period. Prior to the program implementation, the schools were not required to collect any information on health measures of the students.

4.6.3 District Information System for Education (DISE) data

We complement the administrative data collected with DISE data, which are essentially a school-level panel data set containing information on school and teacher characteristics.[52]

The DISE school database was initiated by the Government of India, in conjunction with NUEPA (National University of Educational Planning and Administration, New Delhi). It initially surveyed public primary schools in 1995 in certain districts and states in the country. Starting from 2005, almost all districts and states were included. At present, this database covers 1.2 million schools from over 600 districts across the country.

DISE contains comprehensive, aggregate school-level information on enrolment, medium of instruction, school-level facilities and teacher characteristics. As such, we combine this information with the administrative data collected for the relevant 50 schools in our sample. As mentioned above, DISE data are only available starting from the 2005-2006 academic year onwards.

---

[52] DISE data are essentially a school database and do not contain any pupil-level information. Further, DISE data do not contain any health indicators or data on students' academic performance.

With regards to the enrolment indicators, DISE contains information on grade-level enrolment, plus gender-wise and caste-wise enrolment for each grade. We also observe information on the school facilities and amenities available at each school, for instance, number of classrooms, whether electricity is available, whether drinking water facilities are available, whether the schools have library facilities or if they have computers, etc. Additionally, DISE also contains data on teacher characteristics such as the number of teachers in a given school, number of teachers by gender, proportion of teachers with professional teaching qualifications and whether they possess postgraduate degrees.

Descriptive statistics on school-level and teacher-level characteristics are provided in Table 4.3 for the schools in our sample, during the 2005-2006 academic year (pre-program period), using DISE data. From table 4.3, we see that majority of the schools in the sample are located in urban areas. In particular, 69.7% of the schools are located in urban areas. We also see that 67.3% of schools have the medium of instruction of Kannada (state's official language) while 27.2% have Urdu as the language of instruction and the remaining have Tamil and Telugu as the language of instruction.

Turning to school facilities, 79.9% and 88.2% of the schools have electricity and drinking water availability, respectively. Majority (95.3%) of schools have a library on school premises. Only 19.8% of schools have computer facilities available at the school. On average, the schools have 6.6 classrooms.

Almost all schools (98.4%) receive school development grants sanctioned by the State government, which can be used to finance improvements in terms of infrastructure (classrooms) or other amenities offered by the school. Similarly, we also see that almost all schools are in receipt of Teacher Development grants, which can be used for providing in-service training to teachers and other relevant training programs.

From table 4.3, we also see that schools roughly have one academic inspection per academic year, by officials from the Department of Education. In terms of the teacher characteristics, on average there are 7.7 teachers in a given school. 80.5% of the teachers are female. In terms of their qualifications, nearly all teachers (99%) possess professional teaching qualifications. While, 17.0% of the teachers have postgraduate degrees.

Turning to enrolment indicators, on average, the number of students enrolled in Grades 5-7 is 49.4. The percentage of girls enrolled in Grades 5-7 is approximately 50.9%. By caste, the mean number of Scheduled caste students and scheduled tribe students enrolled in Grades 5-7 are 8.02 and 0.92, respectively. Further, the average number of students belonging to other backward classes enrolled is 11.36. The mean grade repetition rates for students in Grades 5-7 are 1.3%.

In the following section, we discuss the methodology adopted.

4.7 Methodology:

4.7.1 Impact of the School Health Program on Schooling outcomes:

To identify the causal effect of the School Health program on educational outcomes, namely, school participation and academic performance, we exploit the staggered implementation of the program across schools in Karnataka. The timing of rollout of the program was based on distance to Primary health centres and also on the availability of Doctors. More specifically, government primary schools located closer to the primary health centres implemented the program in 2006, whereas schools located further away implemented the program in subsequent academic years. The following figure illustrates the rollout of the program for the 50 schools in the sample. 25 schools in the sample implemented the program at the start of the 2006-2007 academic year, while the remaining 25 schools implemented it 2 years hence, in the 2008-2009 academic year.

Figure 4.3: Timeline of Program rollout

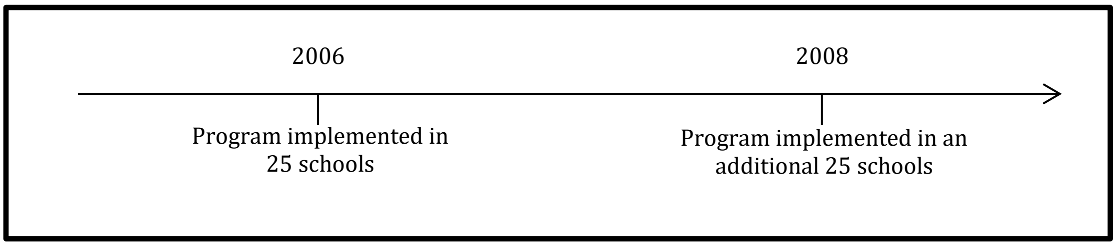


Table 4.3 provides descriptive statistics on school-level and teacher characteristics using DISE data, separately for the early program schools and the late program schools during the 2005-2006 academic year, one year prior to the implementation of the school health program. We do not find significant differences in the pre-treatment characteristics between the two groups of schools, with the following exceptions – the early program schools have significantly more students enrolled and more classrooms and teachers on average than the late program schools. The former are also more likely to be located in urban areas relative to the latter.

In Panel A of table 4.4, we provide descriptive statistics of the main educational outcome variables using the administrative data collected, in the pre-program period, both for the early program schools and late program schools. The sample consists of 5th, 6th and 7th grade students between the 2003-2004 academic year and 2005-2006 academic years (pre-program period). From table 4.4, we see that the students in the treated schools have lower standardized test scores in all 5 core subjects, compared to the control schools, although the differences are not statistically significant. With regards to school participation measures, average attendance is 85% in all schools. Average attendance is slightly lower in the treated schools, compared to the control schools, though the difference is not significant. We also see that 5.3% of students in the treated schools are long-term absent, compared to 4.2% of students in the control schools. On average, the exam take-up rate is 71.4% and difference in exam take-up rates between the treated and control schools are not statistically significant.

In order to empirically estimate the impact of the program on educational outcomes, we employ a difference-in-differences estimation strategy. Essentially, this approach enables us to compare the change in educational outcomes in schools that implemented the program earlier to those schools that implemented the program later. The early implementers received 2 additional years of exposure to the program, before the program was phased into the remaining 25 schools. We therefore estimate the effect of two years of exposure to the program.[53]

Accordingly, we estimate the following empirical specification to identify the program impact:

$$y_{igst} = \alpha + \delta(Treatment_s * Post_t) + \mu_g + \gamma_s + \theta_t + \beta_0 X + \varepsilon_{igst} \qquad (1)$$

Where, y_{igst} denotes the outcome of interest for pupil i, in grade g in school s in year t. The treatment variable is an indicator for the schools that implemented the program in 2006. Post is a binary variable picking up the post treatment period, that is, it captures the academic years 2006-2007 and 2007-2008. Treatment*Post is the interaction between the Treatment and Post variables. This interaction between the treatment and post variables captures the students in treated schools in the post-program period. As such, δ is the parameter of interest, reflecting the difference-in-differences estimator.

We include year fixed effects θ_t and school fixed effects, γ_s. The specification also includes grade fixed effects μ_g in order to exploit the within-grade or within-cohort variation. This enables us to control fully for all school-level and grade-level time invariant characteristics. Thereby, eliminating any bias that may arise from unobserved heterogeneity at the school or grade level. Lastly, X is a vector of student characteristics and time-varying school characteristics. The former includes gender, caste and religion of student i as the student-level characteristics. As the treatment was administered at the school level, we cluster standard errors at the school level.

[53] As described earlier in the Data section, we have data on educational outcomes for students in Grades 5-7 between the 2003-2004 academic year and the 2007-2008 academic years (before the program is phased into the control schools).

Next as an extension to equation (1), we include subject fixed effects in the empirical specification, in order to estimate the program impact on students' academic performance. More specifically, we estimate the following:

$$y_{imgst} = \alpha + \delta(Treatment_s * Post_t) + \mu_g + \gamma_s + \theta_t + \varphi_m + \beta_0 X + \varepsilon_{imgst} \quad (2)$$

In this case, y_{imgst} denotes the standardized test scores for student i in subject *m*, grade *g,* in school *s* and in year *t*. As before, θ_t, γ_s and μ_g represent year fixed effects, school fixed effects and grade fixed effects, respectively. φ_m denotes subject fixed effects. Thus, this approach relies on a within-grade, within-school and within-subject estimation strategy. By including subject fixed effects, we are able to exploit the within-subject variation and further, we can control for time invariant characteristics at the subject–level.

4.7.2 Impact of the School Health Program on Health outcomes:

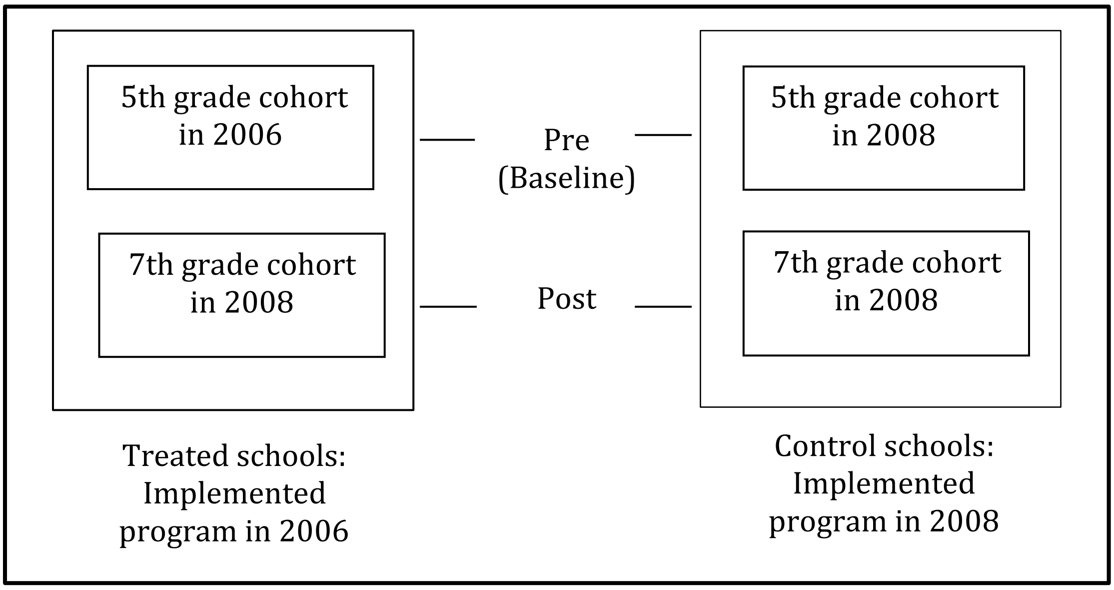
In order to evaluate the impact of the program on health outcomes, we will once again adopt a difference-in-differences estimation strategy. However as mentioned in Section 4.6.2, the health indicators are only available in the post-program period. That is, we observe the health outcomes for students in the treated schools from the 2006- 2007 academic year onwards. While, for the control schools, we only observe health outcomes of students, following the implementation of the program in the 2008-2009 academic year. As such, we do not observe any health outcomes in the pre-program period, as the schools only recorded this data, following the implementation of the School Health Program.

In order to circumvent the problem of having no data prior to the program implementation, we adopt a different approach compared to the one described above in section 4.7.1. This is illustrated in the following figure (figure 4.4).

As a first difference, we compare the health outcomes between students in Grade 5 in the treated schools in 2006 with 5th grade students in 2008 in the control schools. This first difference represents the difference in baseline health status between students in Grade 5 in the treated and control schools. The baseline health status refers to the health status of students in the first year of implementation of the program.

As a second difference, we compare students in 7th grade in 2008 in the treated schools with 7th grade students in 2008 in the control schools. As such, the 7th grade students in 2008 in the treated schools have 2 additional years of exposure to the program, relative to their counterpart in the control schools.

Figure 4.4: Illustration of the Methodology adopted to estimate Program Impact on Health outcomes



Thus, in this case, as a first difference we compare the health outcomes of students in the respective year of implementation of the program, between treated and control schools. The second difference involves comparing students in 2008 in the treated schools with corresponding students in the control schools in 2008. As such, in 2008, only students in the treated schools would have 2 additional years of exposure to the program, relative to the control schools.

Accordingly, we will estimate the following empirical specification:

$$y_{ist} = \alpha + \delta Treatment_s * Post_t + Post_t + \gamma_s + \varepsilon_{ist} \quad (3)$$

Where, y_{ist} is the outcome variable for student i in school s in year t. As before, Treatment is an indicator for the treated schools or the early implementers. The interaction Treatment*Post captures the children in the treated schools, in the post program period, that have 2 years of exposure to the program in the 2008-2009 academic year. γ_s denotes school-level dummy variables. As before, we cluster standard errors at the school level.

This approach relies on the crucial assumption that the trends in health outcomes are similar between the treated and control schools. Thus, we will verify that the baseline health status of children in the treated schools in 2006 is not significantly different from the health status of children in 2008 in the control schools. This is described in more detail in the next section.

4.7.3 Identification Assumptions:

4.7.3.1 Educational outcomes:

The difference-in-differences estimation strategy described above in section 4.7.1 relies on the validity of the common trends assumption, namely, that the treatment and control group follow the same trends in the outcome of interest. This is done to ensure that we are comparing groups that are similar and not drastically different.

We plot the trends for each of the outcome variables, separately for the treated and control schools. We first present the trends in standardized test scores of students in the 5 subjects that they are examined on, in addition to the average test score in Figure 4.5.[54] We standardize all test scores such that they have mean equal to zero and the variance equals one. Standardization is done within subject, grade and academic year.

From Figure 4.5, we see that the trends are indeed parallel between the treated and control schools in the pre-program period. Next, in Figure 4.6, we plot the trends in the school participation indicators, namely annual attendance, exam take up and long-term absence.[55] Annual attendance (proportion) has been calculated as a ratio of the total number of days a student was present in an academic year to the school working days in that academic year.

Figure 4.6 reveals that before the implementation of the program, the trends in school participation indicators appear similar between the treated and control schools. This is encouraging and further lends support to the identification strategy adopted. From figure 4.6, we also see relative improvements in school participation measures in the treated schools, following the implementation of the program in the 2006-2007 academic year.

Event Study Analysis:

The graphical comparisons presented earlier, was a cursory check to test whether the treated and control schools follow the same trends in the outcomes of interest, in the pre-program period. In this section we present the results from the event study analysis. This enables us to explicitly test for the presence of significant differential pre-trends in the outcomes of interest, in a regression framework.

[54] The average test score is computed by taking the arithmetic mean of the test scores in all 5 core subjects (equally weighted average).

[55] Exam take up is measured as a binary indicator picking up whether the student was present and sat the exam. Long-term absence is also measured as a binary variable indicating whether the student was absent for a period of more than one month in an academic year.

More specifically, we estimate the following specification:

$$y_{igst} = \alpha + \sum_{t=2004}^{t=2007} \delta\,(Treatment_s * \; Year_t) + \mu_g + \; \gamma_s + Year_t + \; \beta_0 X + \varepsilon_{igst} \qquad (4)$$

Where, y_{igst} denotes the outcome of interest for pupil i, in grade g in school s in year t. The treatment variable is an indicator for the schools that implemented the program in 2006. Year is an indicator variable for each year. The omitted category is the interaction between the treatment variable and the 2003 year indicator, which is before the implementation of the program. The specification also includes a vector of student level controls X, school fixed effects, γ_s and grade fixed effects μ_g.

The results from estimating equation 4 are reported in Table 4.5. We do not find evidence of statistically significant differential pre-trends in the outcomes of interest, between the treated and control schools. This further validates the identification strategy adopted.

4.7.3.2 Health outcomes:

In this section, we test whether the difference in baseline health status of children are significantly different between treated and control schools. As illustrated in figure 4.4, the baseline health status refers to the health status of students in the first year of implementation of the program. This corresponds to 5th grade students in the treated schools in the 2006-2007 academic year and correspondingly, 5th grade students in the control schools in the 2008-2009 academic year.

As a cursory check, we plot the distribution of the anthropometric indicators, separately for the treated and control schools. Figure 4.7 plots the kernel density plots of height-for-age z scores of children in 5th grade in 2006 in the treated schools alongside the corresponding z-scores for children in 5th grade in 2008 in the control schools.[56] The height-for-age z scores are plotted separately for boys (panel A), girls (panel B) and for all students in Panel C. The two-sample Kolmogorov-Smirnov test of equality of distributions does not reject the null hypothesis of equality of distributions between the treated and control schools in each of the 3 panels.

In Figure 4.8, we present the kernel density plots of weight-for-age z scores between 5th grade students in 2006 in the treated schools and 5th grade students in 2008 in the control schools. Once again, from the Kolmogorov-Smirnov test, we find that the distributions between the treated and control schools are not significantly different.

Furthermore, descriptive statistics reported in Panel B of Table 4.4, also show that the difference in baseline health outcomes between the treated and control schools are not statistically significant.

As a further check, we test whether the treated group had outcome variables that were different and statistically so, in the pre-reform (baseline) period, relative to the control schools, in a regression framework. To do so, we estimate the following specification:

$$y_{is} = \alpha + \beta Treatment_s + \varepsilon_{is} \qquad (5)$$

In this case, y_{is} denotes the outcome of interest for student *i*, in school *s.* As before, treatment is a binary variable, picking up the early program schools. We focus on a sample of 5th grade students in 2006 in the treated schools and 5th grade students in 2008 in the control schools (the first year of program implementation).

The results from estimating equation 5 are presented in Table 4.6. We do not find any significant difference in anthropometric indicators between the treated and control schools at baseline (at time of implementation of the program between treated and control schools). We also stratify the sample by gender and present the results for anthropometric indicators for girls

[56] We have computed the height-for-age z scores by subtracting the median height and dividing by the standard deviation, for each age in each year. In a similar manner, we have also computed weight-for-age z scores, where the standardization was conducted separately for each age and year.

and boys separately (in columns 2,3, 5 and 6). Once again, we do not find statistically significant differences between the treated and control schools at baseline.

In the following section, we present the results of the program impact on educational and health outcomes.

4.8 Results

4.8.1 Impact of the program on student performance:

Table 4.7 presents the results of the program impact on pupils' test scores in each of the 5 core subjects studied (Columns 1-5). From Column 2 of table 4.7, we see that the program led to an improvement in test scores in Mathematics by 18% of a standard deviation for students in the treated schools relative to the control schools.

The program effect on pupils' test scores in First language (medium of instruction), Science, Social science and English are positive, but statistically insignificant. In column 6, we provide the results of the program on average test scores. We find that the program effects are positive but insignificant. In column 7, we include subject fixed effects and we report the results of the program effects on stacked test scores, by estimating equation 2.[57] From column 7, we see that the program had a positive, but statistically insignificant effect on stacked test scores.

In sum, we find that the program had a positive impact on student's test scores in Mathematics, while having a statistically insignificant impact on Language scores, science and social science scores.

In the next section, we examine whether the program had an impact on school participation indicators.

[57] We stack test scores such that there are 5 rows of observations for each student, in each of the 5 core subjects.

4.8.2 Impact of the program on school participation:

We provide results of the program impacts on school participation measures, by estimating equation 1 in Table 4.8.

From column 1 of Table 4.8, we see that students are less likely to be long-term absent as a result of the program. In particular, the results indicate that students in the treated schools were 1.1 percentage points less likely to be long term absent, relative to the control schools. We also find an increase in exam take-up by 4.3 percentage points (column 2, Table 4.8).

From column 3, we find that the program led to an increase in attendance by 5 percentage points in the treated schools relative to control schools, following the program introduction in 2006.

These results are able to shed a light on the mechanisms that are driving the results. First, one of the channels, which is influencing the positive program effects on attendance, could be due to the decline in student illness as a result of the program. Second, this improved attendance is, in turn, another important factor driving the positive program effects on standardized test scores, particularly Mathematics.

In the next section, we estimate whether the program had any heterogeneous effects.

4.8.3 Heterogeneity analysis –

In this section, we examine whether the program effects on student performance and school participation had a heterogeneous effect by (i) gender (ii) grade and (iii) years of exposure to the program.

Lastly, we also assess whether the program effect on students' test scores had a heterogeneous effect across the students' performance distribution.

4.8.3.1 Heterogeneity analysis - Gender

In this subsection, we study whether the program had a differential effect by gender. In Tables 4.9 and 4.10, we report the results from estimating equation 1, for subsamples stratified by gender.

From Panel A in Table 4.9, we see that the program had a positive and statistically significant impact on girls' standardised Mathematics test scores. In particular, the program led to an increase in Mathematics test scores by 16% of a standard deviation for girls in the treated schools relative to girls in control schools. Consistently, we also find positive and significant program effects on boys' standardized test scores in Mathematics (see Panel B).

The program effects on test scores in other subjects (English, science, first language and social science) are positive but statistically insignificant for both boys and girls.

We also find that the program effects on school participation measures are very similar for girls and boys (Table 4.10). The program had a positive and significant effect on attendance and exam take up rates for both boys and girls. The program impact on being long-term absent are negative but statistically insignificant for both boys and girls.

As such, the findings indicate that the program affected both boys and girls.

4.8.3.2 Heterogeneity analysis - Grade

In this subsection, we evaluate whether the program had differential effects by grade. Accordingly, we present the results from estimating equation 1, for 5th grade, 6th grade and 7th grade separately.

From panel A of Table 4.11, we find that the program led to a significant increase in test scores in Mathematics, English, the average test scores and stacked test scores for 5th grade students in the treated schools, relative to the control schools. For 6th grade students, the program effects on test scores in all 5 subjects are positive but statistically insignificant (Table 4.11, Panel B). In panel C of Table 4.11, the coefficient estimates indicate a statistically significant increase in Mathematics test scores for 7th grade students, following the introduction of the program. The program effects on language scores, science and social science test scores are not significant.

Thus, the findings indicate that the positive impact of the program on standardized test scores are mainly driven by students in Grades 5 and 7. The differential program effects by grade perhaps reflect the differences in the syllabus across different grades.

With regards to the program effects on school participation measures, we consistently find positive and significant program effects on attendance and exam take up rates for 5th, 6th and 7th grade students (Table 4.12). The estimated coefficients of the program impact on being long term absent are negative, but statistically insignificant for students in Grades 5-7.

4.8.3.3 Heterogeneity analysis- Years of Program Exposure

We evaluate whether the program had a heterogeneous effect across students with differential years of exposure to the program.

Students in the treated schools would have at most 2 years of exposure to the program between 2006 and 2008, before the program is implemented in the control schools in 2008. In particular, students in the treated schools would have one year of exposure to the program if the program were introduced in their final year of primary school for these students. For instance, students in 7th grade in 2006 in the treated schools only benefit from one year of exposure from the program, since they finish primary school at the end of the 2006 academic year and would subsequently leave. Whereas, students in 6th grade in 2006 in the treated schools would potentially have 2 years of exposure to the program as they would benefit from the program not only in 2006, but also in 2007 when these students are in the 7th grade. Similarly, students in 5th grade in 2006 would also potentially have 2 years of exposure to the program, before the program is phased into the control schools.

As such, following the program implementation, students in the treated schools in our sample would experience either one year or two years of exposure to the program, before the program is phased into the control schools in 2008. Alternatively, students in the treated schools would have no exposure to the program if they completed primary school before the program was implemented.

In this subsection, we evaluate whether the program had a differential effect by years of exposure to the program. In table 4.13 we report the estimates of the differential program effects by years of exposure. The findings suggest that students with 2 years of exposure to the program benefit from an improvement in Mathematics test scores, relative to those with no exposure to the program. Similarly, students with 1 year of exposure also benefit from increased Mathematics scores, compared to those with no exposure. The program effects on language, science and social science test scores are positive but statistically insignificant for students in the treated schools with either one or two years of exposure to the program, relative to those with no exposure.

From table 4.14, we find that the program effects on attendance and exam take-up are positive and significant for students with one year of exposure to the program, relative to those students with no exposure. Similarly, students with 2 years of exposure to the program also benefit from increased attendance and exam take-up, compared to those with no exposure. We also find that the program impact on long-term absence is not statistically significant for students with either one or two years of program exposure (Column 1).

4.8.3.4 Heterogeneity analysis - Performance distribution

Thus far, we have only evaluated the program effect on students' academic performance at the mean or the average program effects. In this section, we examine whether the program had heterogeneous effects for students belonging to different quantiles of the performance distribution.

In order to do so, we estimate the quantile treatment effects applied to the DID setting (Athey & Imbens, 2006). The quantile difference-in-differences relies on the assumption that the trends in the outcome of interest, at a particular quantile are the same in the treated and control schools, in the pre-program period. Or put differently, that the changes in the outcome variable at a particular quantile would have been the same in the treated and control schools, in the absence of the School Health program.

We estimate the program effect at quantile τ of the conditional distribution using the following empirical specification.

$$Q_{yigst}(\tau|\ Treatment_s * Post_t, \gamma_s, \mu_g, \theta_t) = \beta(\tau)\ Treatment_s * Post_t + \gamma_s(\tau) + \mu_g(\tau) + \theta_t(\tau) \quad (6)$$

The dependent variable is the conditional quantile function at quantile τ of the test score distribution of student i in grade g, school s in year t. As before, treatment is an indicator for the treated schools and Post is a binary indicator for the post-program period. γ_s denotes school fixed effects and μ_g captures grade fixed effects. The specification also includes year fixed effects θ_t. We cluster standard errors at the school level.[58]

The results from estimating equation 6 are provided in Table 4.15, Columns 1-5.

For Mathematics, the program effects are positive and significant for children at the median and at the top quantiles of the performance distribution. In particular, the program leads to an increase in Mathematics test scores for children at the median by 18.6% of a standard deviation, which is close to the Difference-in-differences coefficient (Column 6). The program effects are positive but statistically insignificant for children in the lowest decile.

Additionally, from Table 4.15, the coefficient estimates indicate that that the program led to an increase in language test scores -both the first language and English test scores in the lowest decile (significant at the 5% level). But

[58] We estimate quantile treatment effects and cluster standard errors at the school level using the 'qreg2' command in Stata 14 (Machado, Parente and Silva, 2015).

the program effects are statistically insignificant further up in the performance distribution.

We also find evidence that the program introduction led to an increase in the average test scores in the lowest decile by 15.9% of a standard deviation. The effects are positive but statistically insignificant as one moves up the performance distribution.

For science and social science, the coefficients of the program effects are positive but insignificant across the performance distribution.

Thus, in sum, we do find evidence of heterogeneous effects across the different quantiles of the performance distribution of the different subjects. The program had a positive effect on English, first language and the average test scores in the lowest decile. While, for mathematics, the program effects were positive and significant at the median and the top of the performance distribution.

In the next section, we report the results of the program effects on health outcomes.

4.8.4 Impact of the Program on Health outcomes:

We first begin by estimating equation (3) by comparing students in 5th grade and students in the 7th grade between treated and control schools, as illustrated in Figure 4.4. The dependent variables are anthropometric indicators, namely weight-for-age z scores, height-for-age z scores and body mass index (BMI).[59]

The results are provided in Table 4.16. In column 1, we present the program impact on Weight-for-age z scores for all students. In columns 2 and 3, we

[59] Body Mass index is calculated by dividing weight (measured in kilograms) by the square of height (measured in metres).

provide the results of the program impact, separately for girls and boys, by stratifying the sample by gender.[60]

From Columns 1-3, we see that the coefficient estimates of the program impact on weight-for-age scores are positive, but statistical significance is not detected. In terms of the program impacts on height measures and BMI, we once again find that the program effects are positive, but statistically insignificant.

Thus far, we have estimated the program effects at the mean. However, this may mask heterogeneities across the distribution of health indicators. Thus, we estimate the quantile treatment effects using the following specification:

$$Q_{yist}(\tau | \, Treatment_s * Post_t, Post_t \,, \gamma_s) = \beta(\tau) \, Treatment_s * Post_t + Post_t + \gamma_s(\tau) \qquad (7)$$

The dependent variable is the conditional quantile function at quantile τ of the distribution of health outcomes for student i in school s in year t. As before, Treatment is an indicator for the treated schools and the interaction between treatment and post captures students in the treated schools with exposure to the program. γ_s denotes school-level dummy variables. As before, we cluster standard errors at the school level.

The results from estimating equation 7 are provided in Table 4.17. For weight-for-age z scores, we find that the program impacts are positive across the distribution, but the estimated coefficients are not statistically significant. Similar results are found for the program impact across the distribution of height-for-age z scores. Further, for both girls and boys, the program effects across the distribution of health outcomes are positive, but none of the coefficients are statistically significant.

One plausible explanation for the lack of statistically significant results could be that these children are too old to benefit from height and weight gains, as a result of the program. Evidence from the related literature indicates that the window for benefitting from such programs are during early childhood

[60] The weight-for-age z scores are computed separately for girls and boys in columns 2 and 3, respectively.

or even through in-utero maternal health interventions. As such, school-aged children – particularly children in 5^{th} grade and 7^{th} grade (aged between 10 and 12), maybe too old to benefit from these programs.

Another plausible explanation is that we are unable to precisely estimate the program impact on health outcomes, due to the absence of health data prior to the implementation of the program.

4.8.5 Robustness Checks:

In this section, we perform a couple of robustness checks to test the sensitivity of our results.

In all of the results presented above, we have clustered the standard errors at the school level, as the treatment was administered at the school level. Cluster-robust standard errors allow for heteroskedasticity and arbitrary correlation of standard errors within clusters (schools), given that the number of clusters (schools) is large.

A large literature demonstrates that cluster-robust standard errors might be downward biased if the number of clusters in the sample is small (Angrist and Lavy 2002; Bertrand, Duflo, and Mullainathan 2004; Donald and Lang 2007; Moulton 1986, 1990). This is because inference is based on the asymptotic assumption that the number of clusters tends to infinity (Cameron & Miller, 2015; Ibragimov and Muller, 2016).

Cameron, Gelbach, and Miller (2008) illustrate that wild bootstrap methods perform particularly well in estimating standard estimates with small numbers of clusters.[61] In our context, the estimation results are based on 50 clusters, as we have 50 schools in the analysis. As an additional robustness check, we apply the wild bootstrap procedure developed by Cameron, Gelbach, and Miller (2008) to account for the comparably small number of clusters in this study.

[61] The wild bootstrap method was developed by Wu (1986), Liu (1988), and Mammen (1993).

The results from applying the wild bootstrap procedure are provided in Tables 4.18 and 4.19.[62] We find that the inference on the program effects on educational and health outcomes remain unchanged. We still continue to find that the program effects on student's Mathematics test scores are positive and significant at the 5% significance level. Inference based on the wild cluster p-values yields similar results of the program effects on the other subjects as found in section 4.8.1.

In terms of the program effects on school participation measures, we also continue to find positive and significant program effects on attendance and exam take up. We also find that the coefficient estimates on long-term absence are negative and significant at the 10% significance level. Similarly, the inference of the program impact of health indicators remains unchanged (Table 4.19). More specifically, we find that the program impacts on health outcomes are positive, but statistically insignificant.

Next, as an additional robustness check, we include school-specific linear time trends to our main specification (equations 1 and 2).[63] The results are provided in Table 4.20. We find that the results are robust to the inclusion of school specific time trends. In columns 8-10, which presents the results of the program impact on school participation indicators, we find that the inference on all coefficients remains unchanged, though the estimated program effects are larger than those reported in Table 4.8 (without school-specific time trends). In particular, students in the treated schools are 2 percentage points less likely to be long term absent, relative to the control schools. We also find that the estimated coefficients suggest an increase in attendance by 7.1 percentage points and exam take-up by 5.2 percentage points, following the program introduction.

From Table 4.20, we also find a positive and statistically significant increase in Mathematics scores, Average test scores and stacked test scores for

---

[62] We use the "cgmwildboot" command in Stata 14.

[63] We provide results on the program impact on students' academic performance and school participation, controlling for school–specific linear time trends in Table 4.20. However, we are unable to control for school time trends when evaluating the impact of the program on health outcomes, as we only have 2 time periods (see Figure 4.4).

students in the treated schools, relative to the control schools, following the program implementation.

4.8.6 Threats to validity:

In this section, we discuss some potential threats to our identification strategy and attempt to address them.

First, a plausible threat to the identification strategy would be the non-random migration of students across schools to take advantage of the program. We address this by examining whether there was an increase in enrolment in the treated schools at the time of implementation of the program in 2006. Further, the increased enrolment may lead to crowded classrooms, which in turn, would lead us to underestimate the program effects on academic performance.

In order to address this, we regress log enrolment in school s, grade g and year t on the interaction between the treated schools indicator and the post dummy. The results are provided in Table 4.21. From Column 1, table 4.21, we find that the coefficients are statistically insignificant. In column 2, we include the interaction between the treated schools indicator with the 2006 year dummy (the year of program introduction) and with the 2007 year dummy as explanatory variables. Once again, we find that the coefficients of these interaction terms are not statistically significant. Thus, this provides suggestive evidence that the program did not lead to increased enrolment or crowded classrooms.

Second, in our setting, we have missing observations for some students. In particular, the test scores, attendance and health outcomes are missing for some pupils.[64] This would be problematic if the missing observations are correlated with the treatment variable (i.e. if there were differential missing

[64] In most cases, there were missing data only if the child was absent for the exam or if the child was absent on the day of the health check up. It must also be noted that we do not have missing observations at the school level or grade level or subject level, where scores are missing for all pupils in a given school or grade or subject, respectively. Rather, we have missing observations for some pupils within a grade in an academic year.

observations between the treated and control schools in the pre-program period).

In order to address this concern, we test whether the missing observations for each of the outcome variables are correlated with the treated schools. We create a binary variable which picks up whether any of the observations are missing for each of the outcome variables. We regress these "missing" binary variable indicators on the treated schools dummy variable. The results are provided in Tables 4.22 and 4.23. In panel A of Tables 4.22 and 4.23, we provide the results for the pre-program period.[65] In panel B, we provide the results for all periods (pre and post program periods).

We find that none of the coefficients are statistically significant. As such, this provides suggestive evidence that missing observations are not correlated with the treatment variable, and so does not pose a threat to the identification strategy.

Third, other programs implemented at the same time, as the School Health program could be another concern. The Government provision of cooked school meals has been in operation since the 2002-2003 academic year in all public primary schools in Karnataka. As such, since both the treated and the control schools in our setting have been implementing the school meals program, we do not believe this to be a threat to the identification strategy.

Fourth, it is certainly a concern that the test scores and other academic outcomes may be inflated/higher in administrative data, in developing countries. However, this measurement error would lead to attenuation bias rather than leading to an overestimate of the program effects. Further, we do not believe that there was differential measurement error between the treated and comparison schools, as this would lead us to underestimate or overestimate the program effects. We are able to assuage some of these concerns, as the data collected was retrospective in nature.

[65] For educational outcomes, the sample consists of students in the pre-program period (between the 2003-2004 academic year and the 2005-2006 academic years). For health outcomes, we focus on the sample of 5th grade students in 2006 in the treated schools and 5th grade students in 2008 in the control schools (the respective years of introduction of the program, between treated and control schools).

Fifth, differential teacher absenteeism rates between the treated and control schools is another concern. The related literature indicates high teacher absenteeism rates in Public schools in developing countries (Duflo, Hanna and Ryan, 2012; Kremer et al. 2004). Unfortunately, we do not have data on teacher absenteeism, in order to explicitly control for it in the empirical analysis. However, during the unannounced school visits in order to collect the administrative data, most of the teachers were present in the school.

Lastly, another potential threat to the validity of the identification strategy would be spillover effects generated by the program onto control schools. That is, control schools located in close proximity to the treated schools may also benefit from positive health externalities generated by the program, and this in turn may lead us to underestimate the program effects. In the remainder of this section, we attempt to estimate spillover effects by controlling for Neighbouring control schools that are located within 5 kilometres from the treated schools. Thus, we estimate the following empirical specification.

$$y_{igst} = \alpha + \delta\, Treatment_s * Post_t + \rho Neighbour_s * Post_t + \mu_g + \gamma_s + \theta_t + \varepsilon_{igst} \qquad (8)$$

As in equation 1, y_{igst} is the outcome of interest for pupil i in grade g from school s, in year t. As before, treatment is an indicator for the treated schools or early program schools that implemented the program in 2006. Post in an indicator for the post program period. Neighbour is an indicator for whether control school s is located within 5 kilometres from the treated school. The omitted category refers to the remaining control schools that are located further away from the treated schools (more than 5 kilometres away).

Thus, the coefficient of interest is the coefficient on the interaction between post and the neighbouring control schools indicator, which yields the estimate of spillover effects following the program introduction. The specification also includes grade fixed effects μ_g, school fixed effects γ_s and year fixed effects θ_t. As before, standard errors are clustered at the school level.

The results from estimating equation 8 are provided in Table 4.24 for educational outcomes and Table 4.25 for health outcomes. The estimated coefficients of the spillover effects are not statistically significant across all outcome variables. As such, we do not find any evidence of spillover effects or contamination between the treated and control schools, as a result of the program.

4.8.7 Discussion:

The findings from the previous sections indicate that the School health Program had a positive and significant effect on students' educational outcomes, particularly, attendance, exam take up and standardized test scores. We also find evidence of differential program effects by grade and years of exposure to the program. By gender, we find positive program effects on academic performance and school participation indicators for both boys and girls. The findings also indicate heterogeneous program effects across the pupils' performance distribution and across subjects.

In terms of the program effects on school participation, the results from this study are consistent with the findings from the related literature (Bobonis, Miguel & Sharma, 2006; Miguel & Kremer, 2004). The above-mentioned studies find increased attendance as a result of a combined deworming and iron supplementation program and deworming program, respectively. In particular, Miguel and Kremer (2004) find that the deworming program in Kenya led to a decrease in absenteeism by 7 percentage points in the treated schools relative to comparison schools. The magnitude of the program effects is similar to the findings in our study.

Similarly, the findings from Bobonis, Miguel and Sharma (2006) indicate an increase in pre-school participation rates by 5.8 percentage points or a decrease in absenteeism by one-fifth as a result of a combined iron supplementation and deworming intervention in pre-schools in Delhi. The magnitude of program effects is in line with the results found in this study.

Although, Miguel and Kremer (2004) do not find evidence of improved test scores as a result of the deworming program in Kenya, they reconcile this with the possibility that the program led to more crowded classrooms and this may have offset the positive effects of the program on learning (Glewwe and Miguel, 2008). In our setting, we do not find evidence of crowded classrooms as a result of the school health program, as we explicitly tested whether the program led to increased enrolment, following the program implementation in the previous section (see section 4.8.6 and Table 4.21).

Moving to the program impact on health indicators, in our study, we find that the program effects on health outcomes are positive but not statistically significant. We also do not find statistically significant program effects across the distributions of anthropometric indicators. Some plausible explanations for the lack of statistically significant program effects on health outcomes could be due to the age of the children in our setting. That is, the children in Grades 5-7 may be too old to benefit from height and weight gains as a result of the program. Moreover, in our setting, the children were not severely malnourished at the time of their first health check-up.[66] This is pertinent as the research literature finds greatest health gains accrue to children who are malnourished at the outset. Further, the data limitations, in particular, the absence of health data in the pre-program period may limit us from precisely estimating the program impact on health outcomes.

Additionally, we do not observe whether students who were prescribed medicines at the health screening camps actually consumed/ingested them or if they followed the right dosage in a timely manner. Similarly, we do not observe whether the students actually consulted the specialists in local hospitals to receive further treatment for their ailments, in which case, there may be no change in their health and educational status. This would be

[66] All the Government primary schools in our study have been providing children enrolled in the schools with a daily provision of cooked school meals since the 2002-2003 academic year. As such, this cooked school meals program may have, to some extent mitigated malnutrition prevalent among the children enrolled in public primary schools. As a result, in 2006 and 2008, at the time of implementation of the School Health program in the treated and control schools, respectively, a large proportion of children did not suffer from severe malnutrition. Further, majority of the children in our sample reside in urban areas and therefore may not be severely malnourished, relative to children in rural settings.

particularly true for students with impaired vision, for instance, who do not seek treatment or those that don't don spectacles following treatment.[67]

In terms of the related literature, Bobonis, Miguel and Sharma (2006) find evidence of weight gains from a randomised intervention of providing children with iron supplementation and deworming treatment. They however, do not find any increase in height-for-age z scores. Although they do find increased weight as a result of the health intervention, their sample consisted of pre-school children aged between 2 and 6 years. By contrast, in our study, the sample consists of children aged 10 and 12, and as such, these children may be too old to benefit from increased anthropometric indicators.

In contrast to the results by Bobonis, Miguel and Sharma (2006), Miguel and Kremer (2004) find that the provision of deworming treatment to children in Kenya led to a small increase in height-for-age z scores of children, but not weight-for-age gains. They rationalize these results by stating that "Thein-Hlaing, Thane-Toe, Than-Saw, Myat-Lay-Kyin, and Myint-Lwin's (1991) study in Myanmar finds large height gains among treated children within six months of treatment for roundworm while weight gains were only observed after twenty-four months, and Cooper et al. (1990) present a similar finding for whipworm, so the result is not unprecedented."

In the remainder of this section, we discuss the potential mechanisms that are driving the results in our study.

The main channel driving the positive program impact on students' academic performance is the increased attendance as a result of the program. Students spend more time at school and this translates to an increase in test scores, particularly in Mathematics. We also find that the program generated an increase in language test scores and the average test scores at the lowest decile.

[67] Glewwe et. al. (2012) find that the take-up of spectacles by children in rural China was low due to cultural and traditional beliefs, even though the spectacles were offered free of cost.

The program had a positive impact on academic performance for both boys and girls, which may be driven by the increased attendance affecting both boys and girls equally. The increased attendance, following the program implementation may be driven by the decrease in absenteeism resulting from illness.

Another plausible channel for the improved attendance and students' academic performance could, to some extent, arise from the improvement in health status of the children. Although we do not find positive, statistically significant program impacts on anthropometric indicators, the program could have potentially generated an improvement in health status through reducing the incidence of worm infections, improving cognitive function through vitamin and iron supplementation or through correcting impaired vision by prescribing spectacles to the students at the health check-ups. Further, at the health check-ups, children diagnosed and subsequently treated for an illness may have benefitted more, relative to children that were adequately healthy at baseline.

Another plausible mechanism for the improved attendance and students' academic performance for children in the treated school could be the interaction between the nutritional and health channel. Both the treated and control schools in the sample have been implementing the cooked school meals program since the 2002-2003 academic year.

As such, children in the treated schools may be able to benefit from the interactions from the combination of interventions provided by the school Health program, in addition to the improved nutrition from the school meals program. For instance, the nutritional status of children may be undermined in the presence of worm infestation. Children in the treated schools are provided with deworming medication twice in an academic year, and this may not only reduce the incidence of worm infestations, but also improve the nutritional status of children, by increasing absorption of vitamins, iron supplements and other micronutrients.

Thus the school health program and school meals program are complementary programs and both the health and nutritional channel may be driving factors resulting in improved attendance and academic performance of students in the treated schools.

4.9 Conclusion:

In this study, we evaluated the impact of a unique School Health program implemented in Karnataka, India, on students' educational and health outcomes. The School Health program provided children enrolled in public primary schools with vitamin and iron supplementation, deworming treatment and notably, the program also included Doctor visits to the schools on a periodic basis to conduct health check-ups of the students.

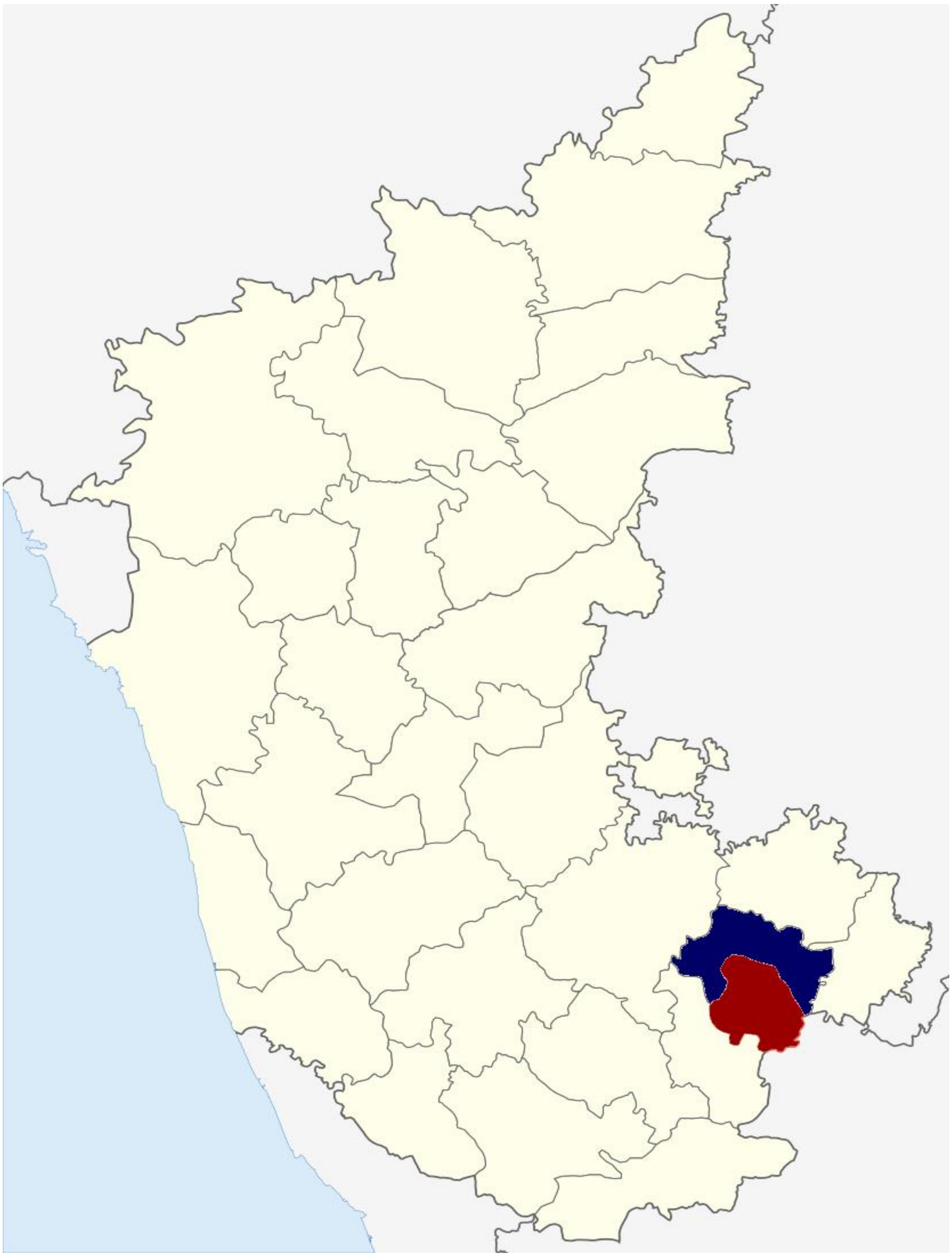
In order to evaluate the program effects, we use administrative data on students' academic and health records, collected from 50 Government primary schools in 2 districts in Karnataka. Exploiting the staggered implementation of the program across schools in Karnataka, we find that program led to improved school participation indicators, using a difference-in-differences estimation strategy. In particular, we find that following the program implementation, students in the treated schools benefit from increased attendance, exam take-up and are less likely to be long-term absent, relative to students in the control schools.

We also find improved academic performance, particularly in Mathematics. The heterogeneity analysis uncovered differential program effects by grade, years of exposure to the program and across the performance distribution of students. In particular, we find positive and significant program effects on Mathematics scores at the median and the top quantiles of the performance distribution. The program effects on language scores and the average test scores are positive and significant at the lowest decile, but insignificant as we move up the performance distribution.

In terms of the program impact on health outcomes, we find positive, but statistically insignificant effects on weight-for-age and height-for-age z scores and on body mass index. We reconcile these findings with the fact that school-aged children in Grades 5-7 may be too old to benefit from weight and height gains, as a result of the program. Additionally, the data limitations may limit us from precisely estimating the program impact on health outcomes.

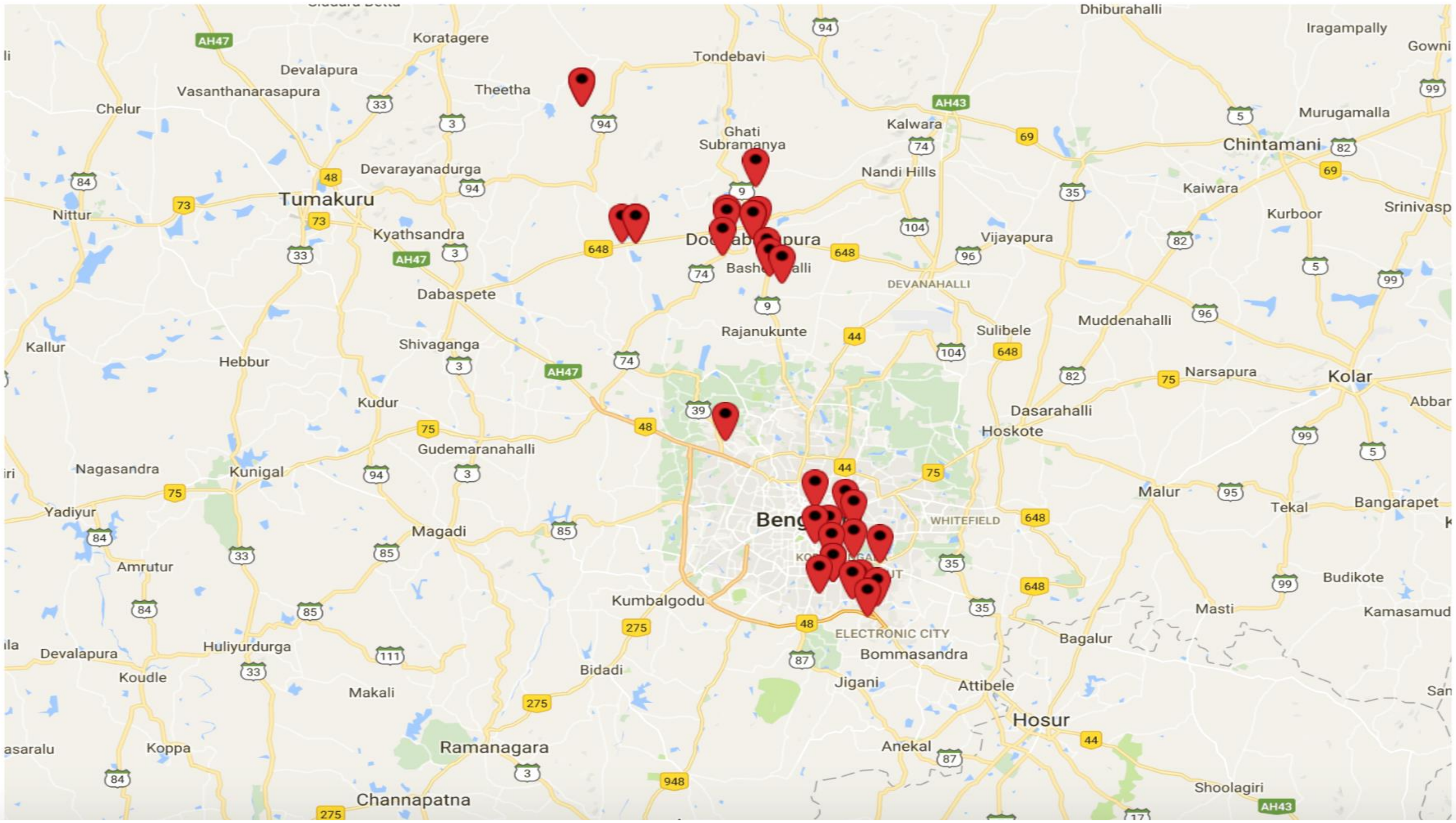
Thus, this study provides suggestive evidence of the positive impacts of School-based health interventions, reiterating that schools are a unique platform in developing countries to deliver affordable health services, thereby removing any barriers in the access to health care. The results from this study would be of great policy relevance. It is concluded that local interventions or national policies designed to improve children's health and nutritional status could have important educational and health benefits.

Figure 4.1: Map of Karnataka state depicting Bangalore Urban and Bangalore Rural districts



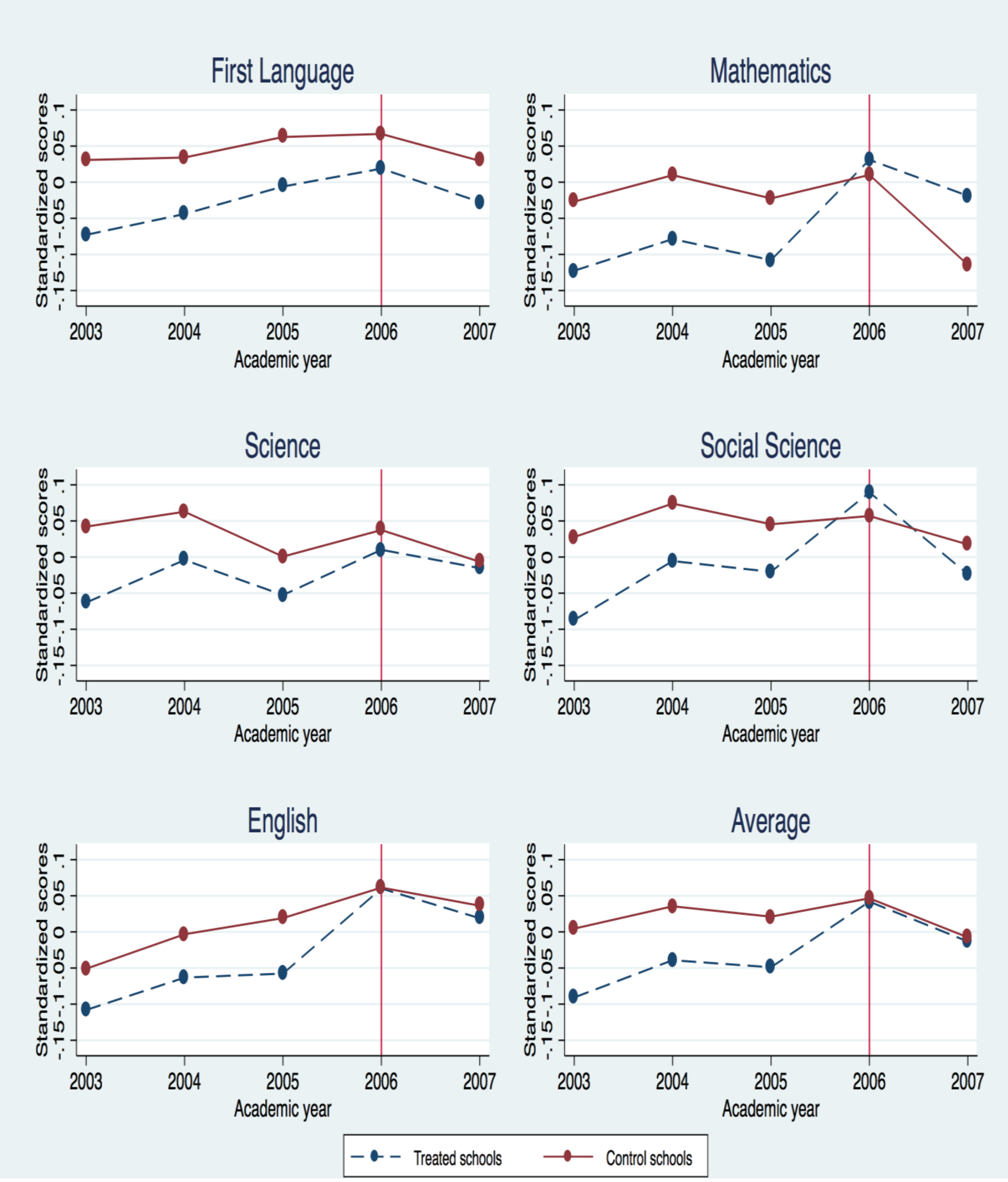
– Bangalore Urban district – Bangalore Rural district

Figure 4.2: Map of schools in the sample



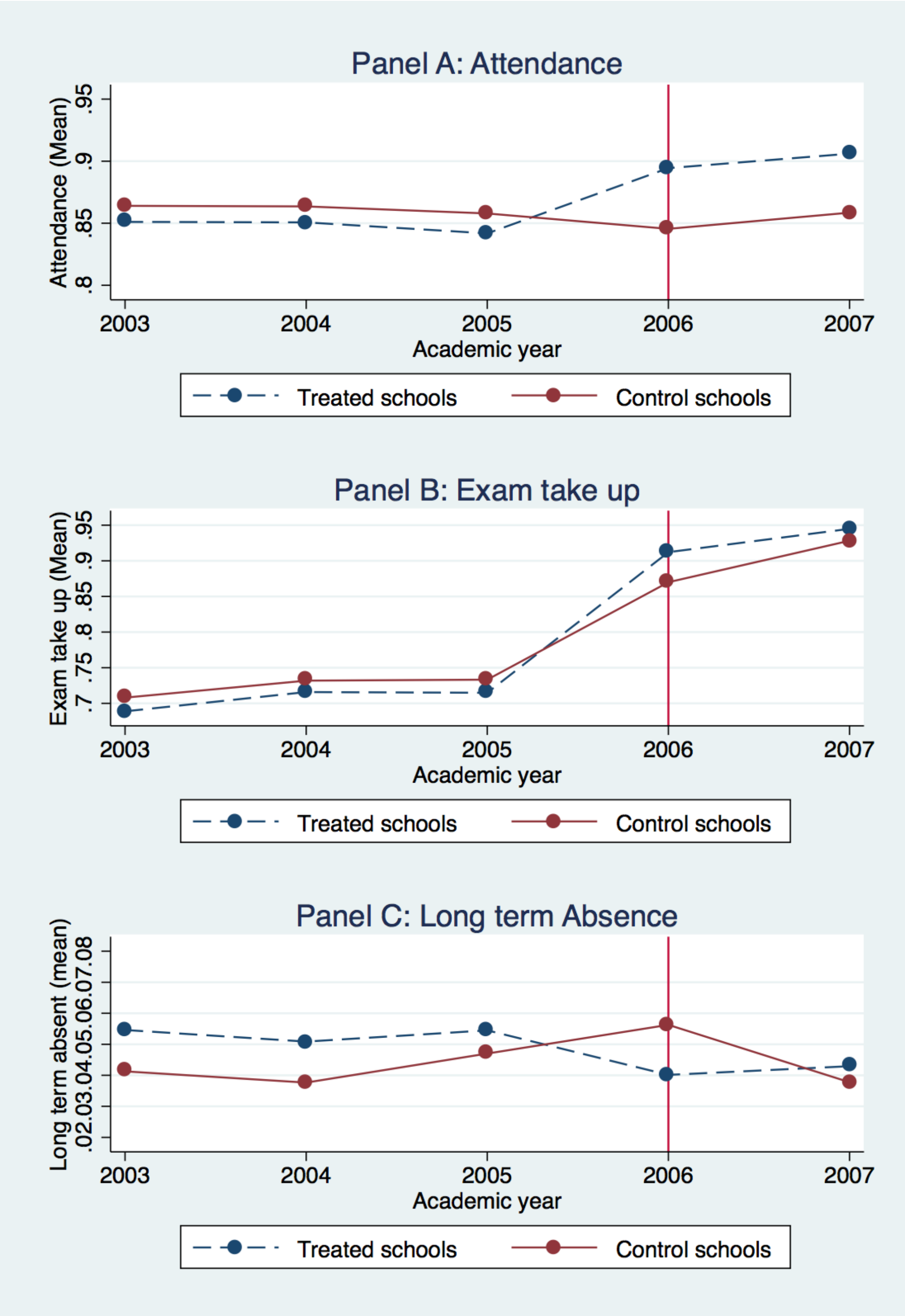
Notes: The map depicts the schools included in the sample. The data collection took place from 2 districts in Karnataka – namely, Bangalore Urban district (south of the map) and Bangalore Rural district (North). Source: Obtained from Google maps.

Figure 4.5: Trends in Outcome variables – Standardized test scores



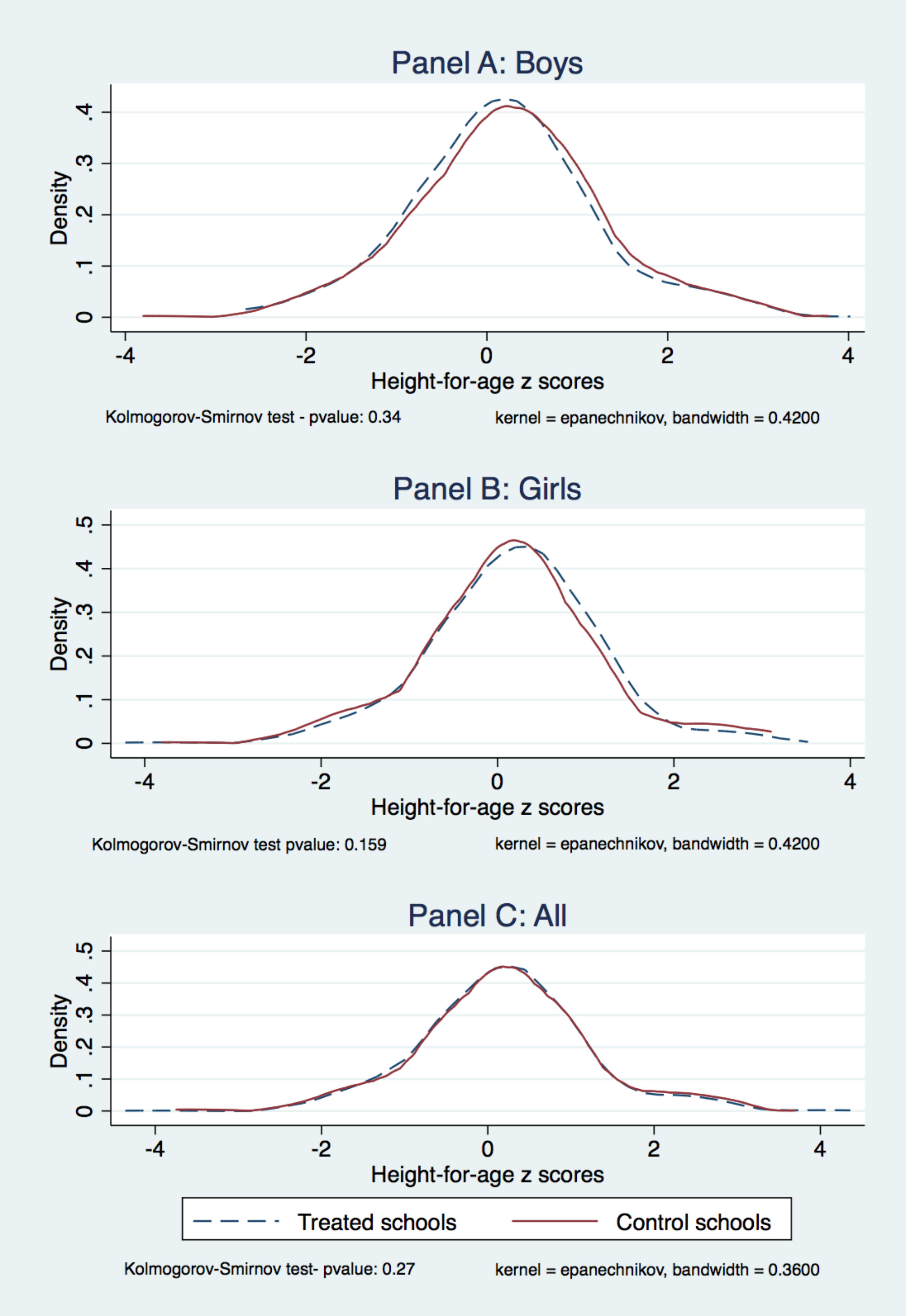
Notes: The Figure presents the trends in standardized test scores, separately for treated and control schools - using the sample of students in Grades 5-7 between the 2003-2004 academic year and 2007-2008 academic years. The treated schools are represented with dashed lines and the control schools are depicted with solid lines. Test scores standardized such that they have mean zero and variance of one. Standardization done within grade, academic year and subject.

Figure 4.6: Trends in outcome variables – School participation measures



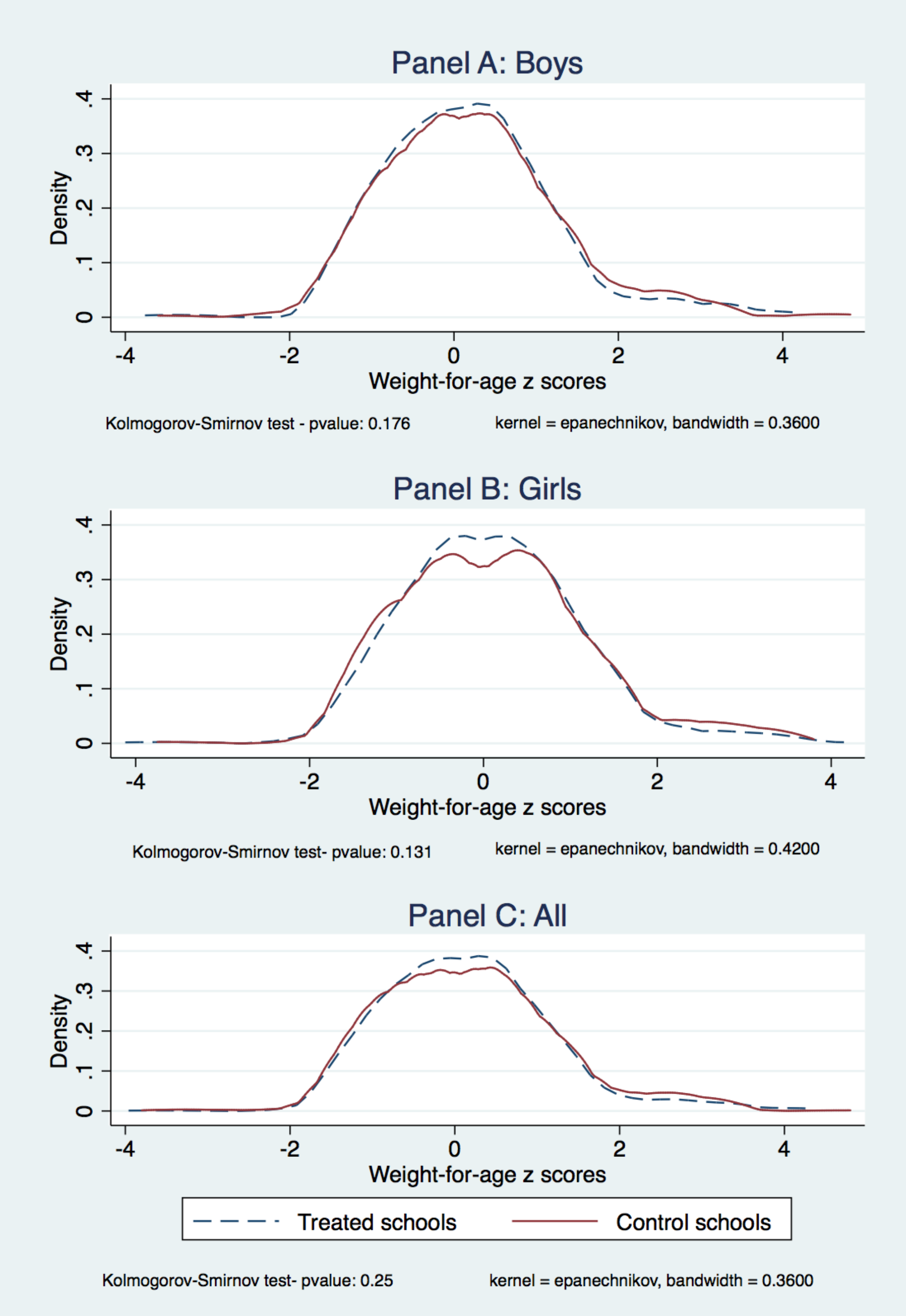
Notes: The Figure present the trends in school participation indicators using the sample of students in Grades 5-7 between the 2003-2004 academic year and 2007-2008 academic years. Panel A presents the trends in attendance between treated and control schools. Panel B illustrates the trends in exam take up rates and Panel C presents the trends in Long-term absence rates between treated and control schools.

Figure 4.7: Kernel Density plots of Height-for-age z scores:



Notes: The figure plots kernel density plots of height-for-age z scores for 5th grade students in the 2006-2007 academic year in the treated schools and corresponding 5th grade students in the 2008-2009 academic year in the control schools – the year of implementation of the program respectively in the early program and late program schools.

Figure 4.8: Kernel Density plots of Weight-for-age z scores:



Notes: The figure plots kernel density plots of weight-for-age z scores for 5th grade students in the 2006-2007 academic year in the treated schools and corresponding 5th grade students in the 2008-2009 academic year in the control schools – the year of implementation of the program respectively in the early program and late program schools.

Table 4.1: Overview of School Health programs in Developing countries

Program	**Program Components**
Fit for school Program in Philippines	1. Daily supervised Hand-washing activity 2. Daily supervised tooth-brushing activity 3. Bi-annual deworming
School Health Promotion program in Sri Lanka	1. Micronutrient supplementation 2. Deworming 3. Health screening 4. Health education 5. Clean drinking water and sanitation facilities
Kenya	1. Deworming 2. Malaria treatment 3. Iron supplementation 4. Health education
Indonesia	1. Nutrition and hygiene education 2. Iron folate supplementation 3. Deworming
Malawi	1. Teacher training to treat malaria 2. Fortified school snacks with micronutrients and iodized salt
Guinea and Madagascar	1. Deworming twice a year 2. Iron folate supplementation 3. Health education included in curriculum 4. Drinking water and sanitation facilities
Tanzania and Ghana	1. Deworming 2. Health and hygiene education
Burkina Faso	1. Vitamin A and iron supplementation 2. Deworming 3. Health and hygiene education

Sources: Jukes, Drake and Bundy (2008) and Bundy (2011)

Table 4.2: Coverage of the School Health Program

Academic Year	Total Number of schools	Number of schools covered by the program	Percentage covered by the program
2006-2007	44,103	23,202	52.6
2007-2008	44,849	24,690	55.1
2008-2009	45,474	38,403	84.5
2009-2010	45,649	42,708	93.5
2010-2011	45,677	43,107	94.4
2011-2012	45,683	43,810	95.9
2012-2013	45,371	43,860	96.6

Source: Department of Public Instruction, Government of Karnataka, India
Notes: The table presents the coverage of the School Health program across all Government primary schools, managed by the Department of Education in Karnataka.

Table 4.3: Descriptive statistics using DISE data for 2005-2006 academic year (pre-program period)

School characteristics	All schools	Early program schools	Late program schools	Difference
Region				
Urban schools (proportion)	0.697	0.8	0.594	0.206***
				(0.060)
Medium of Instruction				
Kannada (proportion)	0.673	0.72	0.625	0.095
				(0.063)
Tamil (proportion)	0.036	0.04	0.031	0.009
				(0.025)
Telugu (proportion)	0.020	0.04	0.000	0.040**
				(0.017)
Urdu (proportion)	0.272	0.2	0.344	-0.144**
				(0.059)
School Facilities and Characteristics				
Electricity available (proportion)	0.799	0.88	0.719	0.161
				(0.109)
Drinking water available (proportion)	0.882	0.92	0.844	0.076
				(0.043)
Playground available (proportion)	0.483	0.56	0.406	0.154**
				(0.066)
Library available (proportion)	0.953	1.00	0.906	0.094
				(0.059)
Year school established (mean)	1953.810	1955.62	1952.000	3.620
				(3.523)
School working days (mean)	230.925	231.00	230.850	0.150
				(0.380)
School Development Grant received (proportion)	0.984	1.00	0.969	0.031
				(0.035)
Teachers Development Grant received (proportion)	0.984	1.00	0.969	0.031
				(0.035)
Computers available (proportion)	0.198	0.24	0.156	0.084
				(0.107)
Average number of classrooms	6.650	7.8	5.500	2.300**
				(0.890)
Number of Academic inspections (Mean)	1.235	1.25	1.220	0.030
				(0.025)
Average Distance from Block resource centre (in kilometres)	1.635	1.43	1.840	-0.410
				(0.608)

Note: Table 3 continued

Table 4.3 continued: Descriptive statistics

School characteristics	All schools	Early program schools	Late program schools	Difference
Teachers				
Teachers (Mean)	7.750	9.14	6.36	2.780***
				(0.609)
Proportion of Female teachers	0.805	0.81	0.8	0.010
				(0.035)
Teachers with Professional teaching qualifications (Proportion)	0.990	0.99	0.99	0.00
				(0.009)
Teachers with Postgraduate degrees (Proportion)	0.170	0.18	0.16	0.020
				(0.047)
Enrolment				
Number of students enrolled in Grades 5-7 (Mean)	49.39	52.36	45.43	6.93***
				(0.598)
Number of Girls enrolled in Grades 5-7 (Proportion)	0.509	0.518	0.50	0.018
				(0.022)
Scheduled caste enrolment in Grades 5-7 (Mean)	8.020	9.7	6.34	3.360***
				(1.157)
Scheduled Tribe enrolment in Grades 5-7 (Mean)	0.92	1.01	0.83	0.18
				(0.7)
Other Backward classes enrolment in Grades 5-7 (Mean)	11.36	13.02	9.70	3.32***
				(0.19)
Grade repetition in Grades 5-7 (Proportion)	0.013	0.014	0.012	0.002
				(0.011)

Notes: Table 4.3 presents the school, teacher and student characteristics of the schools in the sample, constructed from DISE data for the 2005-2006 academic year. The Early and Late program schools refer to the schools that implemented the program in 2006 and 2008, respectively (see Figure 4.3). The differences reported in the last column refer to the difference in characteristics between the early and late program schools. We test whether the differences are significantly different from zero using the standard t-test. Standard errors are provided in parentheses (*** p<0.01, ** p<0.05, * p<0.1)

.

Table 4.4: Descriptive statistics using administrative data - Pre-treatment Characteristics of Outcome variables

Variables	All schools	Treated schools	Control schools	Difference
Panel A: Educational outcomes				
Standardized test scores:				
First language	0.007	-0.040	0.040	-0.080
				(0.097)
Mathematics	-0.053	-0.105	-0.017	-0.088
				(0.108)
Science	0.004	-0.041	0.035	-0.076
				(0.087)
Social science	0.011	-0.040	0.046	-0.087
				(0.101)
English	-0.046	-0.076	-0.025	-0.051
				(0.105)
Average	-0.028	-0.063	-0.004	-0.060
				(0.091)
School participation indicators:				
Attendance	0.855	0.848	0.863	-0.015
				(0.021)
Long-term absent	0.048	0.053	0.042	0.012
				(0.018)
Exam take up	0.714	0.707	0.724	-0.017
				(0.055)
Panel B: Health outcomes				
Weight-for-age z scores	0.162	0.159	0.164	-0.005
				(0.056)
Height-for-age z scores	0.202	0.197	0.209	-0.011
				(0.053)
Body Mass index (BMI)	16.510	16.456	16.578	-0.122
				(0.125)

Notes: Panel A presents the descriptive statistics on educational outcomes, using the sample of students in Grades 5-7, between the 2003 and 2005 academic years (pre-program period). Test scores have been standardized such that they have mean zero and variance of one. Attendance is measured as the ratio of the total days the student was present in an academic year to the school working days in that year. Long-term absent is a binary indicator picking up if a student was absent for more than one month in a given year. Exam take up is a binary variable measuring whether a student was present and sat the exam. Panel B presents the descriptive statistics on health outcomes for students in Grade 5 in the treated schools in 2006 and Grade 5 students in 2008 in the control schools (the respective years of program introduction between treated and control schools). Height and weight z-scores have been computed by subtracting the median and dividing by the standard deviation, for each age and each academic year. BMI is computed by dividing weight measured in kilograms, by height squared (measured in metres).

Table 4.5: Testing identification assumption - Event study analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Test scores:							School participation:		
	First language	Math	Science	Social science	English	Average	Stacked test scores	Long absent	Exam take up	Attendance
treatment_2004	-0.041	0.023	0.079	0.008	0.037	0.037	0.050	-0.002	0.023	0.011
	(0.127)	(0.154)	(0.108)	(0.139)	(0.150)	(0.106)	(0.108)	(0.015)	(0.018)	(0.022)
treatment_2005	-0.035	0.139	0.159	0.116	0.049	0.129	0.133	-0.012	0.015	0.007
	(0.185)	(0.149)	(0.135)	(0.125)	(0.155)	(0.114)	(0.113)	(0.017)	(0.017)	(0.019)
treatment_2006	0.040	0.212*	0.232**	0.240*	0.139	0.199**	0.157	-0.029	0.068***	0.061**
	(0.148)	(0.115)	(0.114)	(0.132)	(0.167)	(0.099)	(0.094)	(0.020)	(0.015)	(0.025)
treatment_2007	0.063	0.302**	0.238	0.084	0.096	0.157	0.170	-0.009	0.041***	0.064**
	(0.152)	(0.148)	(0.177)	(0.195)	(0.197)	(0.154)	(0.153)	(0.018)	(0.015)	(0.024)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
School fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Grade fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Subject fixed effects	No	No	No	No	No	No	Yes	No	No	No
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	24,072	23,991	24,052	23,871	24,018	24,129	120,004	27,119	27,119	26,036
R-squared	0.124	0.132	0.092	0.130	0.132	0.185	0.111	0.057	0.239	0.062

Notes: The table presents the results from the Event study analysis, using the sample of students in Grades 5-7 between the 2003-2004 and 2007-2008 academic years. Treatment is an indicator for the schools, which implemented the program in 2006. Treatment_2004 is the interaction term between the treatment variable and the 2004 year dummy. The omitted category is the interaction between the treatment variable and the 2003 year dummy. Columns 1-6 and columns 8-10 include year, school and grade fixed effects. Subject fixed effects are also included in column 7. The controls include student characteristics, namely, female dummy variable and caste indicators. Test scores standardized to have mean zero and variance of one. Standardization done within each grade, academic year and subject. Standard errors are clustered at the school level in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Table 4.6: Testing identification assumptions - Baseline Health status

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Weight-for-age			**Height-for-age**			**BMI**
	All	Girls	Boys	All	Girls	Boys	
Treated schools	-0.027	-0.022	-0.057	-0.022	0.046	-0.070	-0.041
	(0.057)	(0.087)	(0.085)	(0.073)	(0.091)	(0.110)	(0.137)
male	0.093			0.102			0.128
	(0.059)			(0.067)			(0.112)
Constant	-0.032	-0.103	0.067	-0.353	-0.540*	-0.123	17.406***
	(0.205)	(0.202)	(0.223)	(0.255)	(0.295)	(0.317)	(0.401)
Observations	1,362	641	721	1,362	641	721	1,362
R-squared	0.017	0.016	0.017	0.018	0.020	0.015	0.031

Notes: The table presents the results from conducting a balancing test, to test whether the baseline health outcomes are significantly different between treated and control schools. The sample consists of students in Grades 5 in 2006 in the treated schools and students in Grade 5 in 2008 in the control schools (The respective years of introduction of the program between the treated and control schools). Treatment is an indicator for the schools, which implemented the program in 2006. Standard errors are clustered at the school level in parentheses (*** $p<0.01$, ** $p<0.05$, * $p<0.1$).

Table 4.7: The impact of the program on students' academic performance

	(1) First language	(2) Math	(3) Science	(4) Social science	(5) English	(6) Average	(7) Stacked test scores
treatment_post	0.044	0.181**	0.101	0.120	0.112	0.113	0.112
	(0.105)	(0.078)	(0.103)	(0.103)	(0.086)	(0.082)	(0.081)
Female	0.032	0.030	0.062**	0.054**	0.047**	0.045**	0.045**
	(0.028)	(0.023)	(0.026)	(0.026)	(0.021)	(0.022)	(0.022)
SC	-0.021	-0.040	-0.081*	-0.053*	-0.056**	-0.049*	-0.050*
	(0.045)	(0.041)	(0.046)	(0.030)	(0.025)	(0.027)	(0.026)
ST	-0.069**	-0.004	-0.025	-0.067*	-0.032	-0.035	-0.039
	(0.029)	(0.028)	(0.044)	(0.038)	(0.042)	(0.025)	(0.024)
Constant	-0.035	-0.090	-0.082	-0.076	-0.066	-0.073*	-0.070
	(0.062)	(0.054)	(0.059)	(0.052)	(0.042)	(0.043)	(0.042)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
School fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Grade fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Subject fixed effects	No	No	No	No	No	No	Yes
Observations	24,072	23,991	24,052	23,871	24,018	24,129	120,004
R-squared	0.134	0.147	0.096	0.138	0.150	0.199	0.111

Notes: The table presents the results of the program impact on pupil's academic performance using the Difference-in-differences methodology- using the sample of students in Grades 5-7 between the 2003-2004 academic year and 2007-2008 academic years. Treatment is an indicator for the schools, which implemented the program in 2006. Post is a binary indicator for the post-program period. Student level controls are also included, in particular, female dummy variable and caste indicators. Columns 1-6 include year, school and grade fixed effects. Subject fixed effects are also included in column 7. Test scores standardized to have mean zero and variance of one. Standardization done within each grade, academic year and subject. Standard errors are clustered at the school level in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Table 4.8: The impact of the program on school participation

	(1) Long-term absent	(2) Exam Take-up	(3) Attendance
treatment_post	-0.011*	0.043***	0.050***
	(0.007)	(0.021)	(0.016)
female	-0.004	0.009*	0.008*
	(0.004)	(0.005)	(0.005)
SC	0.001	0.001	-0.003
	(0.006)	(0.010)	(0.009)
ST	-0.005	-0.011	0.001
	(0.014)	(0.020)	(0.015)
Constant	0.062***	0.754***	0.837***
	(0.005)	(0.032)	(0.008)
Year fixed effects	Yes	Yes	Yes
School fixed effects	Yes	Yes	Yes
Grade fixed effects	Yes	Yes	Yes
Outcome Mean (Pre program)	0.048	0.714	0.855
Observations	27,119	27,119	26,036
R-squared	0.057	0.204	0.062

Notes: The table presents the results of the program impact on student's school participation indicators using the Difference-in-differences methodology, using the sample of students in Grades 5-7 between the 2003-2004 academic year and 2007-2008 academic years. Long-term absent is a binary variable picking up whether the student is absent for more than a month in an academic year. Exam take up is also a binary indicator capturing whether a student was present and sat the exam. Attendance is measured as a ratio of the number of days a student was present in an academic year to the total school working days. Treatment is an indicator for the schools, which implemented the program in 2006. Post is a binary indicator for the post-program period. Student level controls are also included, in particular, a female dummy variable and caste indicators. Columns 1-3 include year, school and grade fixed effects. Outcome mean reports the mean for each of the outcome variables in the pre-program period. Standard errors are clustered at the school level in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Table 4.9: Heterogeneous Impacts of the program on students' test scores- by gender:

	(1) First language	(2) Math	(3) Science	(4) Social science	(5) English	(6) Average	(7) Stacked test scores
Panel A: Program effects for Girls							
treatment_post	0.027	0.162**	0.102	0.145	0.070	0.102	0.101
	(0.104)	(0.080)	(0.103)	(0.108)	(0.083)	(0.080)	(0.080)
Panel B: Program effects for Boys							
treatment_post	0.062	0.204**	0.106	0.098	0.156	0.127	0.125
	(0.111)	(0.081)	(0.111)	(0.105)	(0.097)	(0.087)	(0.086)
School fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Grade fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Subject fixed effects	No	No	No	No	No	No	Yes

Notes: The table presents the results of the program impact on pupil's academic performance, using the sample of students in Grades 5-7 between the 2003-2004 academic year and 2007-2008 academic years. We stratify the sample by gender and present the results for girls in panel A and for boys in panel B. Treatment is an indicator for the schools, which implemented the program in 2006. Post is a binary indicator for the post-program period. Columns 1-6 include year, school and grade fixed effects. Subject fixed effects are also included in column 7. Test scores standardized to have mean zero and variance of one. Standardization done within each grade, academic year and subject. Standard errors are clustered at the school level in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Table 4.10: Heterogeneous Impacts of the program on school participation- by gender:

	(1) Long-term Absent	(2) Exam take up	(3) Attendance
Panel A: Program effects for Girls			
treatment_post	-0.011	0.054***	0.046***
	(0.008)	(0.025)	(0.016)
Panel B: Program effects for Boys			
treatment_post	-0.012	0.031***	0.055***
	(0.009)	(0.010)	(0.018)
School fixed effects	Yes	Yes	Yes
Grade fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes

Notes: The table presents the results of the program impact on student's school participation indicators, using the sample of students in Grades 5-7 between the 2003-2004 academic year and 2007-2008 academic years. We stratify the sample by gender and present the results for girls in panel A and for boys in panel B. Treatment is an indicator for the schools, which implemented the program in 2006. Post is a binary indicator for the post-program period. Columns 1-3 include year, school and grade fixed effects. Standard errors are clustered at the school level in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Table 4.11: Grade level results - test scores

	(1) First language	(2) Math	(3) Science	(4) Social science	(5) English	(6) Average	(7) Stacked test scores
Panel A: Grade 5 results							
treatment_post	0.099	0.154*	0.128	0.100	0.126*	0.125**	0.122**
	(0.103)	(0.084)	(0.109)	(0.095)	(0.073)	(0.057)	(0.057)
Panel B: Grade 6 results							
treatment_post	0.022	0.149	0.100	0.136	0.062	0.087	0.085
	(0.134)	(0.100)	(0.128)	(0.135)	(0.090)	(0.096)	(0.095)
Panel C: Grade 7 results							
treatment_post	0.065	0.238**	0.067	0.137	0.162	0.133	0.134
	(0.155)	(0.115)	(0.121)	(0.150)	(0.140)	(0.117)	(0.117)
School fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Subject fixed effects	No	No	No	No	No	No	Yes

Notes: The table presents the results of the program impact on pupil's academic performance, using the sample of students in Grades 5-7 between the 2003-2004 and 2007-2008 academic years. We stratify the sample by grade and present the results for Grade 5 in panel A, Grade 6 in panel B and grade 7 in panel C. Columns 1-6 include year, school and grade fixed effects. Subject fixed effects are also included in column 7. Test scores standardized to have mean zero and variance of one. Standardization done within each grade, academic year and subject. Standard errors are clustered at the school level in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Table 4.12: Grade level results – school participation

	(1) Long-term absent	(2) Exam take up	(3) Attendance
Panel A: Grade 5 results			
treatment_post	-0.012	0.049***	0.044**
	(0.013)	(0.022)	(0.020)
Panel B: Grade 6 results			
treatment_post	-0.018	0.054	0.052***
	(0.011)	(0.063)	(0.019)
Panel C: Grade 7 results			
treatment_post	-0.003	0.026***	0.054***
	(0.007)	(0.010)	(0.016)
School fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes

Notes: The table presents the results of the program impact on student's school participation indicators, using the sample of students in Grades 5-7 between the 2003-2004 academic year and 2007-2008 academic years. We stratify the sample by grade and present the results for Grade 5 in panel A, Grade 6 in panel B and grade 7 in panel Treatment is an indicator for the schools, which implemented the program in 2006. Post is a binary indicator for the post-program period. Columns 1-3 include year, school and grade fixed effects. Standard errors are clustered at the school level in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Table 4.13: Heterogeneity analysis: Program effect by years of exposure to the program

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	First language	Math	Science	Social science	English	Average	Stacked test scores
Treatment_one year of exposure	0.068	0.159*	0.039	0.091	0.119	0.097	0.095
	(0.094)	(0.093)	(0.108)	(0.134)	(0.124)	(0.088)	(0.088)
Treatment_two years of exposure	0.033	0.190**	0.129	0.134	0.108	0.120	0.119
	(0.118)	(0.081)	(0.108)	(0.093)	(0.079)	(0.083)	(0.082)
female	0.032	0.030	0.061**	0.054**	0.047**	0.045**	0.045**
	(0.028)	(0.023)	(0.026)	(0.026)	(0.021)	(0.022)	(0.022)
SC	-0.021	-0.040	-0.081*	-0.053*	-0.056**	-0.049*	-0.050*
	(0.045)	(0.041)	(0.046)	(0.030)	(0.025)	(0.027)	(0.026)
ST	-0.069**	-0.004	-0.024	-0.067*	-0.032	-0.035	-0.039
	(0.029)	(0.028)	(0.044)	(0.039)	(0.042)	(0.025)	(0.024)
Constant	-0.036	-0.089	-0.079	-0.074	-0.066	-0.072	-0.070
	(0.062)	(0.054)	(0.059)	(0.053)	(0.043)	(0.043)	(0.043)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
School fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Grade fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Subject fixed effects	No	No	No	No	No	No	Yes
Observations	24,072	23,991	24,052	23,871	24,018	24,129	120,004
R-squared	0.134	0.147	0.096	0.138	0.150	0.199	0.111

Notes: The table presents the results of the program impact on pupil's academic performance, using the sample of students in Grades 5-7 between the 2003-2004 and 2007-2008 academic years. Treatment_one year of exposure is an indicator for students in the treated schools, who have one year of exposure to the program. Treatment_two years of exposure is an indicator for students in the treated schools, who have two years of exposure to the program. Test scores standardized to have mean zero and variance of one. Standardization done within each grade, academic year and subject. Standard errors are clustered at the school level in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Table 4.14: Heterogeneity analysis: Program effect by years of exposure to the program

	(1) **Long-term absent**	(2) **Exam take up**	(3) **Attendance**
Treatment_one year of exposure	-0.005	0.041***	0.054***
	(0.006)	(0.018)	(0.018)
Treatment_two years of exposure	-0.014	0.044***	0.048***
	(0.008)	(0.022)	(0.016)
female	-0.004	0.009*	0.008*
	(0.004)	(0.005)	(0.005)
SC	0.001	0.001	-0.003
	(0.006)	(0.010)	(0.009)
ST	-0.005	-0.011	0.001
	(0.014)	(0.020)	(0.015)
Constant	0.062***	0.754***	0.837***
	(0.005)	(0.032)	(0.008)
Year fixed effects	Yes	Yes	Yes
School fixed effects	Yes	Yes	Yes
Grade fixed effects	Yes	Yes	Yes
Outcome Mean (Pre program)	0.048	0.714	0.855
Observations	27,119	27,119	26,036
R-squared	0.057	0.204	0.062

Notes: The table presents the results of the program impact on student's school participation measures, using the sample of students in Grades 5-7 between the 2003-2004 and 2007-2008 academic years. Treatment_one year of exposure is an indicator for students in the treated schools, who have one year of exposure to the program. Treatment_two years of exposure is an indicator for students in the treated schools, who have two years of exposure to the program. Standard errors are clustered at the school level in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Table 4.15: Heterogeneity analysis- Impact of the program across performance distribution

	(1)	(2)	(3)	(4)	(5)	(6)
	Quantile Treatment effects					**DID**
Dependent variable	**Quantile = 0.1**	**Quantile = 0.25**	**Quantile = 0.5**	**Quantile = 0.75**	**Quantile = 0.9**	
First Language	0.174**	0.143*	0.046	0.061	0.14	0.044
	(0.072)	(0.082)	(0.140)	(0.132)	(0.125)	(0.105)
Math	0.102	0.086	0.186**	0.208***	0.236**	0.181**
	(0.093)	(0.081)	(0.088)	(0.081)	(0.099)	(0.078)
Science	0.045	0.076	0.136	0.083	0.013	0.101
	(0.109)	(0.090)	(0.105)	(0.133)	(0.127)	(0.103)
Social science	0.127	0.073	0.147	0.111	0.003	0.120
	(0.104)	(0.110)	(0.107)	(0.122)	(0.110)	(0.103)
English	0.218**	0.158	0.157	0.038	0.043	0.112
	(0.086)	(0.097)	(0.097)	(0.100)	(0.119)	(0.086)
Average	0.159*	0.128	0.081	0.039	0.026	0.113
	(0.085)	(0.088)	(0.100)	(0.111)	(0.102)	(0.082)
Stacked test scores	0.103	0.138*	0.158*	0.073	0.005	0.112
	(0.078)	(0.083)	(0.093)	(0.103)	(0.087)	(0.081)
Year Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Grade fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
School fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The table presents the results from estimating the quantile treatment effects of the program on pupils' standardized test scores. In column 6, we present the results reported in Table 4.7 using the difference-in-differences methodology. Each column is produced from separate regressions, for each of the dependent variables (rows). The coefficients reported are the coefficients of the Treatment*Post variable. For estimating the quantile treatment effects on stacked test scores, we also include subject fixed effects in the empirical specification. The controls include student characteristics, namely, female dummy variable and caste indicators. Standard errors are clustered at the school level in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Table 4.16: The impact of the program on Health indicators

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Weight-for-age			**Height-for-age**			**BMI**
	All	Girls	Boys	All	Girls	Boys	
treatment_post	0.189	0.276	0.114	0.144	0.167	0.123	0.388
	(0.134)	(0.215)	(0.095)	(0.160)	(0.226)	(0.172)	(0.243)
Post	0.145	0.168	0.140**	0.188	0.218	0.114	-0.398*
	(0.108)	(0.171)	(0.067)	(0.136)	(0.195)	(0.128)	(0.197)
male	0.120***			0.135***			0.239**
	(0.037)			(0.044)			(0.108)
Constant	-0.054	-0.045	0.070	-0.054	-0.027	0.104	16.786***
	(0.091)	(0.132)	(0.052)	(0.106)	(0.148)	(0.097)	(0.167)
School fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,076	1,461	1,615	3,076	1,461	1,615	3,076
R-squared	0.042	0.058	0.053	0.082	0.101	0.091	0.062

Notes: The table presents the results of the program impact on health outcomes, using the difference-in-differences methodology as illustrated in Figure 4.4. The sample consists of students in Grade 5 in 2006 in the treated schools, grade 5 students in 2008 in the control schools (the respective years of program implementation) and 7th grade students in the 2008 academic year. Weight-for-age (and height-for-age) z scores have been computed by subtracting the median weight (height) and dividing by the standard deviation. BMI has been calculated by dividing weight (in kilograms) by the square of height (measured in metres). Treatment is an indicator for students in the treated schools. Treatment_post captures the students in the treated schools, who have two years of exposure to the program. In columns 2,3, 5 and 6, we have stratified the sample by gender and have reported the results separately for girls and boys. Standard errors are clustered at the school level in parentheses (*** $p<0.01$, ** $p<0.05$, * $p<0.1$).

Table 4.17: Heterogeneity Analysis - Program impact across distribution of health indicators

	(1) Quantile = 0.1	(2) Quantile = 0.25	(3) Quantile = 0.5	(4) Quantile = 0.75	(5) Quantile = 0.9
Weight-for-age					
All	0.094	0.062	0.115	0.257	0.130
	(0.163)	(0.103)	(0.090)	(0.162)	(0.194)
Girls	0.171	0.063	0.200	0.268	0.171
	(0.144)	(0.202)	(0.160)	(0.191)	(0.178)
Boys	0.040	0.044	0.148	0.115	0.275
	(0.129)	(0.118)	(0.096)	(0.165)	(0.199)
Height-for-age					
All	0.246	0.116	0.090	0.137	0.171
	(0.224)	(0.150)	(0.101)	(0.122)	(0.179)
Girls	0.212	0.239	0.153	0.205	0.175
	(0.198)	(0.210)	(0.121)	(0.144)	(0.327)
Boys	0.101	0.116	0.115	0.075	0.041
	(0.218)	(0.229)	(0.181)	(0.131)	(0.192)
School effects	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes

Notes: The table presents the results from estimating the quantile treatment effects of the program on student's health outcomes. Each column is produced from separate regressions, for each of the dependent variables (rows). The coefficients reported are the coefficients of the Treatment*Post variable. Standard errors are clustered at the school level in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Table 4.18: Robustness Checks- Wild cluster bootstrap (educational outcomes)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Test scores							School participation		
	First language	Math	Science	Social science	English	Average	Stacked test scores	Long-term absent	Exam take up	Attendance
treatment_post	0.044	0.181**	0.101	0.120	0.112	0.113	0.112	0.011*	0.188**	0.050***
	[0.700]	[0.040]	[0.400]	[0.200]	[0.320]	[0.200]	[0.280]	[0.080]	[0.020]	[0.000]
School fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Grade fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Subject fixed effects	No	No	No	No	No	No	Yes	No	No	No
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	24,072	23,991	24,052	23,871	24,018	24,129	120,004	27,119	27,119	26,036
R-squared	0.134	0.147	0.096	0.138	0.150	0.199	0.111	0.057	0.204	0.062

Notes: The table presents the results of the program impact on pupil's academic performance (in Columns 1-7) and student's school participation measures in Columns 8-10, using the sample of students in Grades 5-7 between the 2003-2004 and 2007-2008 academic years. Treatment is an indicator for the schools, which implemented the program in 2006. Post is a binary indicator for the post-program period. Columns 1-6 and columns 8-10 include year, school and grade fixed effects. Subject fixed effects are also included in column 7. Test scores standardized to have mean zero and variance of one. Standardization done within each grade, academic year and subject.

p-Value of the wild bootstrapped standard errors, testing the null hypothesis that the coefficient is zero, is in brackets [*** p<0.01, ** p<0.05, * p<0.1]

Table 4.19: Robustness Checks - Wild cluster bootstrap (health outcomes)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Weight-for-age			**Height-for-age**			**BMI**
	All	Girls	Boys	All	Girls	Boys	
treatment_post	0.189	0.276	0.114	0.144	0.167	0.123	0.388
	[0.260]	[0.140]	[0.220]	[0.360]	[0.660]	[0.340]	[0.220]
Post	0.145	0.168	0.140**	0.188	0.218	0.114	-0.398**
	[0.220]	[0.440]	[0.020]	[0.200]	[0.420]	[0.320]	[0.040]
male	0.120***			0.135***			0.239***
	[0.000]			[0.000]			[0.000]
Constant	-0.244*	-0.177	-0.256**	-0.395**	-0.192	-0.372*	16.745***
	[0.100]	[0.340]	[0.020]	[0.040]	[0.600]	[0.060]	[0.000]
School fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,076	1,461	1,615	3,076	1,461	1,615	3,076
R-squared	0.042	0.058	0.053	0.082	0.101	0.091	0.062

Notes: The table presents the results of the program impact on health outcomes, using the difference-in-differences methodology as illustrated in Figure 4.4. The sample consists of students in 5^{th} grade in 2006 in the treated schools, 5^{th} grade students in 2008 in the control schools (the respective years of program introduction) and 7^{th} grade students in 2008. Treatment is an indicator for the schools, which implemented the program in 2006. Post is a binary indicator for the post-program period.
p-Value of the wild bootstrapped standard errors, testing the null hypothesis that the coefficient is zero, is in brackets [*** p<0.01, ** p<0.05, * p<0.1].

Table 4.20: Robustness Checks - School specific linear time trends

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Test scores:							School participation:		
	First language	Math	Science	Social science	English	Average	Stacked test scores	Long-term absent	Exam take up	Attendance
treatment_post	0.129	0.174*	0.164	0.254	0.162	0.181*	0.177*	-0.020*	0.052***	0.071***
	(0.083)	(0.100)	(0.162)	(0.169)	(0.119)	(0.106)	(0.105)	(0.011)	(0.020)	(0.025)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
School fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Grade fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Subject fixed effects	No	No	No	No	No	No	Yes	No	No	No
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
School specific time trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	24,072	23,991	24,052	23,871	24,018	24,129	120,004	27,119	27,119	26,036
R-squared	0.154	0.167	0.112	0.161	0.162	0.221	0.124	0.057	0.279	0.066

Notes: The table presents the results of the program impact on pupil's academic performance (in Columns 1-7) and student's school participation measures in Columns 8-10, using the sample of students in Grades 5-7 between the 2003-2004 and 2007-2008 academic years. Treatment is an indicator for the schools, which implemented the program in 2006. Post is a binary indicator for the post-program period. The controls include student characteristics, namely, female dummy variable and caste indicators. Columns 1-6 and columns 8-10 include year, school and grade fixed effects. Subject fixed effects are also included in column 7. Columns 1-10 include school-specific linear time trends. Test scores standardized to have mean zero and variance of one. Standardization done within each grade, academic year and subject. Standard errors are clustered at the school level in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Table 4.21: Threats to validity - The impact of the program on enrolment

Log Enrolment	(1)	(2)
treatment_post	0.030	
	(0.055)	
treatment_2006		0.039
		(0.054)
treatment_2007		0.021
		(0.061)
Year fixed effects	Yes	Yes
School fixed effects	Yes	Yes
Grade fixed effects	Yes	Yes
Observations	674	674
R-squared	0.866	0.866

Notes: The table presents the results of the program impact on enrolment, using the difference-in-differences methodology. The dependent variable is the logarithm of school-level enrolment. The sample consists of students in Grades 5-7, between the 2003-2004 and 2007-2008 academic years. Treatment is an indicator for the schools, which implemented the program in 2006. Post is a binary indicator for the post-program period. In Column 2, we include the interaction between the treated schools variable and the 2006 year dummy as well as the interaction between the 2007 year dummy and the treated schools indicator. Columns 1 and 2 include year, school and grade fixed effects. Standard errors are clustered at the school level in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Table 4.22: Threats to validity - Missing observations (educational outcomes)

Missing Observations	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Test scores							School participation		
	First language	Math	Science	Social science	English	Average	Stacked test scores	Long-term absent	Exam take-up	Attendance
Panel A: Pre-program period										
Treated schools	-0.0210	-0.0280	-0.0210	-0.0349	-0.0270	-0.0183	-0.0264	0.0040	-0.0800	0.0452
	(0.0537)	(0.0537)	(0.0540)	(0.0555)	(0.0535)	(0.0542)	(0.0539)	(0.006)	(0.072)	(0.048)
Panel B: All academic years										
Treated schools	-0.0140	-0.0203	-0.0154	-0.0315	-0.0181	-0.0120	-0.0138	0.0047	-0.0093	0.0315
	(0.0323)	(0.0324)	(0.0324)	(0.0358)	(0.0322)	(0.0325)	(0.0102)	(0.0098)	(0.0100)	(0.0358)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Grade fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Subject fixed effects	No	No	No	No	No	No	Yes	No	No	No

Notes: The dependent variable is an indicator for missing observations for each of the outcome variables. In Panel A, the sample consists of students in Grades 5-7, between the 2003-2004 and 2005-2006 academic years (pre-program period). In Panel B, the sample consists of students in Grades 5-7 for all academic years (between 2003 and 2007). Treatment is an indicator for the schools, which implemented the program in 2006. Columns 1-6 and 8-10 include year and grade fixed effects. Column 7 also includes subject fixed effects. Standard errors are clustered at the school level in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Table 4.23: Threats to validity - Missing observations (health outcomes)

Missing observations	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Weight-for-age			**Height-for-age**			**BMI**
	All	Girls	Boys	All	Girls	Boys	
Panel A: Pre-program period							
Treated schools	-0.018	0.052	-0.069	-0.031	0.050	-0.065	-0.023
	(0.036)	(0.049)	(0.048)	(0.022)	(0.049)	(0.048)	(0.015)
Panel B: All periods							
Treated schools	-0.001	0.006	-0.005	0.004	0.007	-0.003	0.004
	(0.013)	(0.030)	(0.029)	(0.014)	(0.030)	(0.029)	(0.016)

Notes: The dependent variable is an indicator for missing observations for each of the outcome variables. In panel A, the sample consists of students in Grades 5 in 2006 in the treated schools and students in Grade 5 in 2008 in the control schools (The respective years of introduction of the program between the treated and control schools). In Panel B, the sample consists of students in Grade 7 in 2008, students in Grade 5 in 2006 in the treated schools and students in Grade 5 in 2008 in the control schools. Treatment is an indicator for the schools, which implemented the program in 2006. Standard errors are clustered at the school level in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Table 4.24: Threats to validity - Spillover effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Test scores:							School participation:		
	First Language	Math	Science	Social Science	English	Average	Stacked test scores	Long-term absent	Exam take up	Attendance
treatment_post	0.076	0.193**	0.156	0.126	0.090	0.125	0.124	-0.012*	0.118***	0.051***
	(0.084)	(0.088)	(0.119)	(0.140)	(0.111)	(0.091)	(0.090)	(0.007)	(0.040)	(0.016)
neighbour_post	0.016	-0.010	-0.007	0.005	-0.184	0.032	0.022	-0.003	0.027	0.015
	(0.228)	(0.152)	(0.119)	(0.183)	(0.335)	(0.175)	(0.175)	(0.033)	(0.018)	(0.022)
Constant	0.004	0.003	-0.009	0.028	0.003	-0.009	-0.024	0.061***	0.804***	0.840***
	(0.055)	(0.047)	(0.047)	(0.047)	(0.059)	(0.040)	(0.052)	(0.005)	(0.018)	(0.007)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
School fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Grade fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Subject fixed effects	No	No	No	No	No	No	Yes	No	No	No
Observations	24,072	23,991	24,052	23,871	24,018	24,129	120,004	27,223	27,223	26,092
R-squared	0.123	0.131	0.090	0.128	0.131	0.182	0.102	0.056	0.191	0.062

Notes: The table presents the estimates of the program effects and spillover effects generated by the program, using the sample of students in Grades 5-7 between the 2003-2004 and 2007-2008 academic years. Treatment is an indicator of the treated schools that implemented the program in 2006. Neighbour is a binary indicator for control schools that are located within 5 kilometres of the treated schools. The omitted category is the remaining control schools, which are located further away (more than 5 kilometres away from treated schools). Post is a binary variable picking up the post-program period. Columns 1-6 and 8-10 include year, school and grade fixed effects. Column 7 also includes subject fixed effects. Standard errors are clustered at the school level in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Table 4.25: Threats to validity - Spillover effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Weight-for-age			**Height-for-age**			**BMI**
	All	Girls	Boys	All	Girls	Boys	
treatment_post	0.228	0.294	0.188	0.150	0.174	0.114	0.380
	(0.160)	(0.239)	(0.115)	(0.184)	(0.194)	(0.252)	(0.255)
neighbour_post	0.066	0.081	-0.050	-0.045	-0.088	0.014	0.111
	(0.142)	(0.203)	(0.113)	(0.168)	(0.220)	(0.166)	(0.237)
post	0.048	0.112	0.047	-0.136	-0.314	0.030	0.313
	(0.156)	(0.253)	(0.142)	(0.157)	(0.209)	(0.184)	(0.298)
male	0.122***			0.132***			0.229**
	(0.034)			(0.042)			(0.108)
Constant	-0.019	-0.044	0.071	0.244*	0.499***	0.135	15.979***
	(0.158)	(0.237)	(0.150)	(0.135)	(0.171)	(0.178)	(0.314)
School fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,076	1,461	1,615	3,076	1,461	1,615	3,076
R-squared	0.077	0.072	0.091	0.124	0.134	0.116	0.071

Notes: The table presents the estimates of the program effects and spillover effects generated by the program on health outcomes. The sample consists of students in 5th grade in 2006 in the treated schools, 5th grade students in 2008 in the control schools (the respective years of program introduction between treated and control schools) and 7th grade students in 2008. Treatment is an indicator of the treated schools that implemented the program in 2006. Neighbour is a binary indicator for control schools that are located within 5 kilometres of the treated schools. The omitted category is the remaining control schools, which are located further away (more than 5 kilometres away from the treated schools). Post is a binary variable picking up the post-program period. Standard errors are clustered at the school level in parentheses (*** $p<0.01$, ** $p<0.05$, * $p<0.1$).

Summary and Conclusions

This thesis investigated the impact of School Nutrition and Health programs implemented by the Government in Public primary schools in India. School nutritional programs in developing countries typically consist of the free provision of nutritious meals, snacks or food rations to students, contingent on enrolment and attaining a minimum attendance criterion. School Health programs are complementary programs that provide children with a variety of free health services, typically consisting of deworming treatment, micronutrient supplementation, health education and Health screenings by Doctors. These programs are implemented with the primary objective of improving children's health and educational status in developing countries.

Section A of this thesis studied the impact of a school feeding program implemented in India in 1995, while Section B assessed the impact of the School Health program implemented in 2006. We provide a summary of section A and section B below, followed by some concluding remarks.

Section A evaluated the impact of the introduction of the National Program of Nutritional support to primary education implemented by the Ministry of Human Resource Development in Government primary schools. The program provided students enrolled in public primary schools with monthly food rations, conditional on enrolment and on meeting a minimum attendance requirement. Chapter 1 of section A provided an overview of school feeding programs implemented in developing countries, followed by a detailed review of the research literature emphasizing the multi-faceted impacts of these programs on educational, health and nutritional outcomes, in addition to children's labour force participation. The related literature has generally found positive impacts on school participation measures and academic achievement, provided that these programs did not displace teaching time. Prior research has consistently found that the greatest health gains resulting from these programs accrue to those children that are malnourished at baseline.

Chapter 2 of section A analysed the impact of the National Program of Nutritional support to primary education on primary school starting age, and enrolment using the National sample survey. We adopted a difference-in-differences estimation strategy, by exploiting both the district-level variation in the program implementation, in conjunction with the within-family variation in the exposure of the program between siblings in the household. The results indicate that the program had a positive effect on starting school at the stipulated age and on enrolment. Additionally, we estimate a discrete time duration model to identify the effect of the program on time to school entry, with respect to the legal entry age. The results suggest that the program not only encouraged children to start school at the stipulated age, but also encouraged older children past the legal entry age to also enrol, who may not have enrolled in the absence of the program.

Next, chapter 3 of section A examined the impact of the National Program of Nutritional support to primary education on lower and upper primary school completion using the District Level Household survey. Similar to the methodology used in Chapter 2, this chapter uses a difference-in-differences estimation strategy to identify the program impact. The findings indicate that the program led to a positive effect on both lower and upper primary school completion, with the effects being larger for girls. Additionally, in this chapter, we attempted to identify potential spillover effects generated by the program, between younger siblings of primary school age and older siblings in the family. In particular, we estimated whether younger sibling exposed to the program, influenced the secondary school enrolment decisions of older siblings. We did not find any evidence of educational spillover effects, as a result of the program.

Lastly, section B investigated the impact of a School Health program implemented by the Government of Karnataka, India in public primary schools on educational and health outcomes. This unique program mandated the provision of a comprehensive health package to students free of cost, which included the provision of micronutrient supplements, deworming treatment and Doctor visits to the schools on a periodic basis to conduct health checks of students. Students diagnosed with an illness at the health checks were provided with free treatment. The identification strategy exploited the timing of program rollout and therefore we adopted a difference-in-differences technique. Using administrative data collected from schools in Karnataka, we find that the program had a positive impact on attendance and exam take-up rates. We also find positive program effects on pupils' test scores, with heterogeneous effects across subjects and across the performance distribution. Further, we find differential program effects by gender, grade and years of program exposure. Turning to health indicators, we find that the program impact on anthropometric measures were positive, but statistically insignificant for both boys and girls.

Overall, Section A and section B has demonstrated that School feeding programs and School health programs are beneficial programs in a developing country context. The results from Section A provides suggestive evidence that school feeding programs are effective in improving children's school participation outcomes, not only encouraging children to enrol in primary school at the stipulated age but also incentivising them to complete primary school. Similarly, results from section B reveal the effectiveness of school-based health interventions in improving children's school participation outcomes and academic achievement.

The success of these programs is contingent upon a number of factors– reaching students in remote areas and endemic regions who need these programs the most, the successful collaboration between education and health ministries so that the program is mainstreamed into schools, adequate financial and human resources to effectively implement these programs, developing cost-effective measures to sustain these programs and ensuring a mechanism is put in place to enforce that these programs are carried out without fail at regular intervals throughout the duration of primary school, and if relevant in pre-schools. Careful monitoring by Government officials to ensure that these programs are being implemented regularly and efficiently can help in achieving the goal of improvement of educational and health status of children in developing countries

Additionally, putting penalties in place to curb corruption and careful supervision of these programs could help realize the full potential objectives of these programs. At the school level, Headmasters and Teachers should ensure that these programs do not displace teaching time, student learning time and do not disrupt the school day. Further the school administration should be well organised so as to cope with the increased enrolment generated by these programs, so as not to lead to crowded classrooms.

The main criticisms of school-based nutrition and health programs are that they are not cost-effective. Policy makers have increasingly come to recognize the benefits of these programs and have recommended that governments in resource-constrained economies should implement these programs with assistance from International aid agencies. Contracting out these programs to be implemented by non-governmental organisations could also make the implementation of these programs more financially feasible.

Another major criticism of these programs is that school-aged children may be too old to reap the full potential benefits of these programs, compared to children below the age of 5 or maternal health interventions. Although maternal health and early childhood health interventions lay the foundation for a healthy start, the continuation of these nutritional and health interventions to pre-school and primary school children are crucial to promote physical and mental development and to prevent micronutrient deficiencies and susceptibility to infections and diseases. Researchers and academics have advocated that maternal health interventions and school nutritional and health programs are complementary programs, and should not be considered as contradictory programs. Further, policy makers have also come to realise that the benefits of these school-based programs outweigh the costs.

In most developing countries, school nutrition and health programs have been limited to primary schools. Expanding the coverage of these programs to secondary school students would be worthwhile from a public policy standpoint. Enrolment in secondary schools is lagging behind in most low-income and middle-income countries, relative to high-income countries. We believe that these programs would assist in achieving universal enrolment in secondary schools, to a certain extent, by encouraging children to stay in school instead of dropping out. Further, the health and nutritional benefits of these programs would aid in improving educational achievement and attainment, thereby potentially leading to higher earnings and quality of life.

Further research maybe inclined to study the long-run effects of School feeding and School health programs on educational and health outcomes. This would be particularly relevant from a policy perspective. It would inform policy makers as to what works in improving children's health and educational status in a developing country context, not just in the short-run but also in the long-run. Further, significant long-term educational and health benefits resulting from these programs would strengthen the need for these programs as this could signify larger returns than previously estimated, relative to the investments made.

References

Abadie A., Angrist J.D., Imbens G. (2002),“Instrumental Variable estimates of the effect of Subsidized Training on the quantiles of Trainee earnings.” Econometrica Vol. 70, No. 1 (January, 2002), 91-117

Adair, L. (1999), “Filipino children exhibit catchup growth from age 2 to 12 years.” *Journal of Nutrition* 129: 1140–1148.

Adelman, S. W., Alderman, H., Gilligan, D.O; Leher, K. (2013), “The impact of alternative food for education programs on learning achievement and cognitive development in Northern Uganda.” enGender Impact: the World Bank's Gender Impact Evaluation Database. Washington DC; World Bank.

Adelman, S. W., D. O. Gilligan, and K. Lehrer, (2008), “How Effective Are Food for Education Programs? A Critical Assessment of the Evidence from Developing Countries.” Food Policy Review No. 9, International Food Policy Research Institute, Washington, DC.

Adrogue, C., Orlicki, M.E. (2013), “Do In-School Feeding Programs Have an Impact on Academic Performance and Dropouts? The Case of Public Schools in Argentina.” Education policy analysis archives, [S.l.], v. 21, p. 50, June 2013. ISSN 1068-2341.

Afridi, F, (2011) “The impact of school meals on School participation: Evidence from rural India,” Journal of Development Studies (Special Section on Impact Evaluation), 47(11): 1636-1656, 2011

Afridi, F. (2009), “Child welfare programs and child nutrition: Evidence from a mandated school meal program in India,” Journal of Development Economics, Volume 92, Issue 2, Pages 152–165

Afridi F, B. Barooah, R. Somanathan, (2013), “School Meals and Classroom Effort: Evidence from India.” Intenational Growth Centre (IGC) working paper March 2013

Afridi F, B. Barooah, R. Somanathan, (2016), “The Mixture as Before? Student Responses to the Changing Content of School Meals in India.” IZA Discussion Paper No. 9924

Ahmed, A. U., (2004), “Impact of feeding children in school: Evidence from Bangladesh,” International Food Policy Research Institute, Washington DC

Ahmed, A. U., and C. del Ninno. (2002), “Food for Education Program in Bangladesh: An Evaluation of Its Impact on Educational Attainment and

Food Security." Food Consumption and Nutrition Division, IFPRI, Washington,DC.

Ahmed A. and M. Arends-Kuenning. (2003), "Do crowded classrooms crowd out learning? Evidence from the Food for Education Program in Bangladesh." Food and Nutrition Bulletin, pp. 377-78.

Ahmed A. and M. Arends-Kuenning. (2006), "Do crowded classrooms crowd out learning? Evidence from the Food for Education Programme in Bangladesh." World Development 34(4):665—684.

Ahmed, A. U., and M. Sharma. (2004), "Food-for-Education Programs with Locally Produced Food: Effects on Farmers and Consumers in Sub-Saharan Africa." International Food Policy Research Institute, Washington, DC.

Ahmed, T., R. Amir, F. Espejo, A. Gelli, and U. Meir (2007), "Food for Education Improves Girls' Education: The Pakistan Girls' Education Programme." World Food Programme, Rome.

Ahuja, A., Kremer, M., and Alix Peterson Zwane. 2010. "Providing safe water: Evidence from randomized evaluations." Annual Review of Resource Economics 2:237-256.

Alderman H., D.A.P. Bundy (2011), "School Feeding Programs and Development: Are We Framing the Question Correctly?" Oxford University Press

Alderman, H., D. O. Gilligan, and K. Lehrer (2008), "The Impact of Alternative Food for Education Programs on School Participation and Education Attainment in Northern Uganda." Draft, World Bank, IFPRI, and University of British Columbia.

Alderman, H., D. O. Gilligan, and K. Lehrer (2012), "The Impact of Food for Education Programs on School Participation in Northern Uganda." *Economic Development and Cultural Change*, 2012, vol. 61, issue 1, 187 - 218

Alderman, H., Hoddinott, J., Kinsey, B. (2006) "Long term consequences of early childhood malnutrition," Oxford Economic Papers 58 (3), 450–474.

Alderman, H., Behrman, J., Lavy, V., Menon, R. (2001) "Child health and school enrolment," Journal of Human Resources 36 (1), 185–205.

Alfano, M., W. Arulampalam and U. Kambhampati (2011), "Maternal Autonomy and the Education of the Subsequent Generation: Evidence from three contrasting states in India," IZA Discussion paper 6019

Andersson, M., P. Thankachan, S. Muthayya, R. B. Goud, A. V. Kurpad, R. F. Hurrell, and M. B. Zimmermann. 2008. "Dual Fortification of Salt with Iodine and Iron: A Randomized, Double-Blind, Controlled Trial of Micronized Ferric Pyrophosphate and Encapsulated Ferrous Fumarate in Southern India." American Journal of Clinical Nutrition 88 (5): 1378–87.

Angrist J.D. and A.B. Krueger, (1990) "The Effect of Age at School Entry on Educational Attainment: An Application of Instrumental Variables with Moments from Two Samples," NBER Working Paper No. 3571, December 1990

Angrist J.D. and A.B. Krueger, (1991), "Does Compulsory Schooling Attendance Affect Schooling and Earnings?" *Quarterly Journal of Economics*, 106, 979-1014

Angrist, J.D., Chernozhukov, V. & Fernández-Val, I. (2006), "Quantile regression under misspecification, with an application to the U.S. wage structure", Econometrica 74(2), 539-563.

Angrist, J.D., and V. Lavy (2002), "The Effect of High School Matriculation Awards: Evidence from Randomized Trials," NBER Working Paper No. 9389.

Angrist J.D., Pischke J.S. (2009), "Mostly Harmless Econometrics: An Empiricist's companion " Princeton University press (Jan 2009).

Angrist J.D., Pischke J.S. (2014), "Mastering 'Metrics: The path from cause to effect." Princeton University Press (Dec 2014).

Arnold, C. 2004. "Positioning ECCD in the 21st Century." Coordinators Notebook 28: 1–34.

ASER (2005-2014), "Annual Status of Education Report (Rural)", New Delhi: Pratham Resource Centre.

Ash, D. M., S. R. Tatala, E. A. Frongillo Jr., G. D. Ndossi, and M. C. Latham (2003), "Randomized efficacy trial of a micronutrient-fortified beverage in primary school children in Tanzania." *American Journal of Clinical Nutrition* 77: 891–898.

Athey, S. & Imbens, G. W. (2006), "Identification and inference in nonlinear difference-in-differences models", Econometrica 74(2), 431-497.

Attanasio, O., Meghir, C., Nix, E. (2015), "Human capital development and parental investment in India." Cowles Foundation Discussion Paper No. 2026.

"Attending an Educational Institution in India: Its Level, Nature and Cost", National Sample Survey Organisation, Government of India, Report 439, 1998

Babu, S., and J. Hallam (1989), "Socioeconomic impacts of school feeding programs: Empirical evidence from a south Indian village." *Food Policy* 14 (1): 58–66.

Baird, S., J.H. Hicks, M. Kremer and E. Miguel, (2011) "Worms at Work: Long-run Impacts of Child Health Gains," Working paper 2011.

Banerjee, A., S. Cole, E. Duflo, and L. Linden (2004), "Remedying education: Evidence from two randomized experiments in India." Massachusetts Institute of Technology, Cambridge, Mass., U.S.A. Mimeo.

Banerjee, A., S. Jacob and M. Kremer, with J. Lanjouw and P. Lanjouw (2005), "Moving to Universal Education: Costs and Tradeoffs" MIMEO, MIT.

Barua, R.R., (2013) "Intertemporal Substitution in Maternal Labor Supply: Evidence using State School Entrance Age Laws," Research Collection School of Economics, 2013

Basiotis, P. P., S. O. Welsh, F. J. Cronin, J. L. Kelsay, and W. Mertz (1987), "Number of days of food intake records needed to estimate individual and group nutrient intakes with defined confidence." *Journal of Nutrition* 117: 1638–1641.

Bautista A., Barker P.A., Dunn J.T., Sanchez M., Kaiser D.L., (1982), "The effects of oral iodized oil on intelligence, thyroid status, and somatic growth in school-age children from an area of endemic goiter." Am J Clin Nutr. 1982 Jan;35(1):127-34.

Behrman, J. R. (1999), "Labor markets in developing countries." In *Handbook of labor economics,* volume 3B, ed. O. Ashenfelter and D. Card. Amsterdam, San Diego, Oxford, and London: Elsevier.

Behrman, J. R., and J. Hoddinott (2000), "An evaluation of the Impact of PROGRESA on pre-school child height." Report submitted to PROGRESA. Washington, D.C.: International Food Policy Research Institute.

Behrman, J.R., and Hoddinott J. (2005), "Program Evaluation with Unobserved Heterogeneity and Selective Implementation: The Mexican Progresa Impact on Child Nutrition," Oxford Bulletin of Economics and Statistics 67:4, 547-569.

Behrman, J.R. and Lavy V. (1994), "Child Health and Schooling Achievement: Association, Causality, and Intra-household Allocations", World Bank Living Standards Measurement Study Paper No. 104, 1994.

Behrman, J.R. (1996). "The impact of health and nutrition on education". World Bank Research Observer 11 (1), 25–37.

Behrman, J.R., Sengupta P, and Todd P.E. (2005) Progressing through PROGRESA: An impact assessment of Mexico's school subsidy experiment." Economic Development and Cultural Change. 54:1 (October) 237-275.

Bertrand, M., E. Duflo, and S. Mullainathan (2004), "How Much Should We Trust Differences in-Differences Estimates?" Quarterly Journal of Economics, 119, 249-275.

Bhargava, A., (2003) "Family planning, gender differences and infant mortality: evidence from Uttar Pradesh, India," Journal of Econometrics, 112 (2003) 225 – 240

Black, S.E., P.J. Devereux, and K.G. Salvanes, (2008) "Too Young to Leave the Nest? The Effects of School Starting Age," NBER Working Paper No.13969, 2008

Bobonis, G., Miguel, E., Sharma, C.P. (2006). "Iron deficiency, anemia and school participation". Journal of Human Resources 41 (4), 692–721.

Brooker, S. (2009), "Malaria Control in Schools: A Toolkit on Effective Education Sector Responses to Malaria in Africa." Washington, DC: World Bank; London: Partnership for Child Development.

Brooker, S., H. Guyatt, J. Omumbo, R. Shretta, L. J. Drake, and J. Ouma, (2000), "Situation Analysis of Malaria in School-Aged Children in Kenya: What Can Be Done?" Parasitology Today 16 (5): 183–86.

Browning, M., and P.A. Chiappori (1998), "Efficient intra-household allocations: A general characterization and empirical tests." *Econometrica* 66 (6): 1241–1278.

Bundy, D.A.P. (1988). "Population ecology of intestinal helminth infections in human communities". Philosophical Transactions of the Royal Society of London Series B 321 (1207), 405–420.

Bundy, D.A.P. (1997), "This Wormy World: Then and Now," Parasitology Today, 13407–8.

Bundy, D. A. P. (1997), "Health and Early Child Development." In M. E. Young (Ed.), *Early Child Development: Investing in our children's future* (pp. 11-39). Amsterdam: Elsevier.

Bundy, D.A.P (2005), "School Health and Nutrition: Policy and Programs." *Food and Nutrition Bulletin* 26 (2 Suppl 2): S186–92.

Bundy, D. A. P., & Guyatt, H. L. (1996), "Schools for health: Focus on health, education and the school-age child." *Parasitology Today, 12*(8), 1-16.

Bundy, D.A.P., Joshi A, Rowlands M and Yung-Ting Kung (2003), "EnVISIONing Education in Low Income Countries." The World Bank. Washington, D.C.

Bundy, D.A.P, and B. Strickland (2000), "School Feeding/Food for Education Stakeholders' Meeting." USAID Africa Bureau Office of Sustainable Development, Washington, DC.

Bundy D.A.P., Burbano C., Grosh M., Gelli A., Jukes M., Drake L. (2009) "Rethinking School Feeding: Social safety nets, Child Development and the Education sector." The International Bank for Reconstruction and Development / The World Bank

Bundy D.A.P., Shaeffer S, Jukes M, et al. "School-based Health and Nutrition Programs," in: Jamison DT, Breman JG, Measham AR, et al., editors. Disease Control Priorities in Developing Countries. 2nd edition. Washington (DC): The International Bank for Reconstruction and Development / The World Bank; 2006. Chapter 58

Bundy, D. A. P., S. Shaeffer, M. Jukes, K. Beegle, A. Gillespie, L. Drake, S.h. F. Lee, A.M. Hoffman, J. Jones, A. Mitchell, C. Wright, D. Barcelona, B. Camara, C. Golmar, L. Savioli, T. Takeuchi, and M. Sembene (2006), "School-Based Health and Nutrition Programs." In *Disease Control Priorities in Developing Countries: Second Edition*, ed. D. Jamison, J. G. Breman, A. R. Measham, G. Alleyne, M. Claeson, D. Evans, P. Jha, A. Mills, and P. Musgrove, 1091–1108. New York: World Bank/Oxford University Press.

Bundy, D.A.P. (2011), "Rethinking School Health: A key component of Education for All." World Bank

Caldes, N., and A. U. Ahmed (2004), "Food for education: A review of program impacts." International Food Policy Research Institute, Washington, D.C. Mimeo.

Cameron A C, Gelbach JB, Miller DL (2008), "Bootstrap-Based Improvements for Inference with Clustered Errors" Review of Economics and Statistics Volume 90, Issue 3, August 2008 p.414-427

Cameron A C, Gelbach JB, Miller DL (2006), "Robust Inference with Multi-way Clustering" NBER working paper No. 327

Cameron A C, Miller DL (2015), "A Practitioner's Guide to Cluster-Robust Inference" Journal of Human Resources, Spring 2015, vol. 50 no. 2 317-372

Cameron A.C. and P.K. Trivedi, (2005) "MICROECONOMETRICS: Methods and Applications." Cambridge University Press, New York May 2005

Cavan K.R., Gibson R.S., Grazioso C.F., Isalgue A.M. Ruz M. & Solomans N.W. (1993), "Growth and Body Composition of Periurban Guatemalan Children in Relation to Zinc Status: A Cross-Sectional Study." Am J Clin Nutr 57 (3), 334-343. 3 1993.

Centre for Global Development Report (2007), "Peru's Handwashing initiative."

Chakraborty, T., Jayaraman, R, (2016), "School Feeding and Learning Achievement: Evidence from India's Midday Meal Program," CESifo Working Paper No. 5994.

Chaudhury, N., J. Hammer, M. Kremer, K. Muralidharan, F. H. Rogers. (2006), "Missing in Action: Teacher and Health Worker Absence in Developing Countries", Journal of Economic Perspectives, Winter 2006, pp 91-116

Clarke, S. E., Jukes, M. C., Njagi, J. K., Khasakhala, L., Cundill, B., Otido, J., Brooker, S. (2008). Effect of intermittent preventive treatment of malaria on health and education in schoolchildren: a cluster-randomised, double-blind, placebo-controlled trial. *Lancet*, *372*(9633), 127–138.

Conners, C., and A. Blouin. 1982/83. "Nutritional effects on behavior of children." *Journal of Psychiatric Research* 17: 193–201.

Croke K., (2014), "The long run effects of early childhood deworming on literacy and numeracy: Evidence from Uganda." Working paper.

De Heer H.D., Koehly L., Pederson R., Morera O. "Effectiveness and Spillover of an After-School Health Promotion Program for Hispanic Elementary School Children." *American Journal of Public Health*. 2011; 101(10): 1907-1913.

Del Rosso, J. M. (1999), "School Feeding Programs: Improving Effectiveness and Increasing the Benefit to Education. A Guide for Program Managers." Partnership for Child Development, Oxford, UK.

Del Rosso, J. M., and T. Marek. (1996), "Class Action: Improving School Performance in the Developing World through Better Health and Nutrition." Directions in development. Washington DC; World Bank.

Department of Public Instruction, Government of Karnataka (2013), "Suvarna Arogya Chaitanya"

Department of Public Instriction, Government of Karnataka (2014), “Rashtriya Bal Swasthya Karyakram (School Health Programme)”

Dickson, R., Awasthi S., Williamson P., Demellweek C., Garner P. (2000), “Effect of Treatment for Intestinal Helminth Infection on Growth and Cognitive Performance in Children: Systematic Review of Randomized Trials,” British Medical Journal, 320 (June 24), 1697–1701.

District Information System for Education, India. (2008a). Analytical Report and Tables, 2007-2008.

District Information System for Education, India. (2008b). Elementary Education in Rural/Urban India, 2007-2008.

District Information System for Education, India (2009-2014), Analytical Report and Tables

District level household and facility survey, International Institute for Population Sciences, 2002-2004

District level household and facility survey, International Institute for Population Sciences, 2007-2008

Dobkin, C. and F. Ferreira, (2007) “Do School Entry Laws Affect Educational Attainment and Labour Market Outcomes?” Working Paper, 2007

Donald, S.G. and K. Lang. (2007), ”Inference with Difference-in-Differences and Other Panel Data," The Review of Economics and Statistics, 89(2), 221-233.

Drake L., Woolnough A., Burbano C, Bundy D.A.P. (2016), “Global School Feeding Sourcebook: Lessons from 14 countries.” Imperial college Press ISBN 9781783269112

Dreze, J. and G. Kingdon, (2000), “School participation in rural India,” Review of Development economics, 2000, 1-33

Dreze, J. and A. Goyal, (2003), “The future of mid-day meals,” Economics and Political weekly, 2003, 4673-4683

Duflo, E, “Schooling and Labor market consequences of school construction in Indonesia: Evidence from an unusual policy experiment,” American Economic Review, 91 (4), 2001, 795-813

Duflo, E, Hanna R, Ryan SP, (2012) "Incentives Work: Getting Teachers to Come to School," American Economic Review, Vol. 102 No. 4 June 2012 (pp. 1241-78)

Dupas, P. and E. Miguel (2016), "Impacts and Determinants of Health Levels in Low income countries," forthcoming Handbook of Field Experiments

FAO (Food and Agriculture Organization of the United Nations) (1985), "Energy and protein requirements." Report of a joint FAO/WHO/UNU expert consultation. World Health Organization Technical Report Series 724. Geneva: World Health Organization.

Fernando D. S., Rodrigo C. and Rajapakse S., "The 'hidden' burden of malaria: cognitive impairment following infection." Malaria Journal, 2010, Volume 9, Number 1,

Fernando, D. S., Carter, Mendis, & Wickremasinghe, (2006), "A randomized, double-blind, placebo-controlled, clinical trial of the impact of malaria prevention on the educational attainment of school children." American Journal of Tropical medicine and hygiene, Mar;74(3):386-93.

Field E, Robles O, Torero M., (2009) "Iodine deficiency and schooling attainment in Tanzania," American Economic Journal: Applied Economics 2009, 1:4, 140–169

Fit for School (2009), "Project Information Brief." Department of Education, Manila

Galasso, E., and M. Ravallion (2005), "Decentralized Targeting of an Antipoverty Program." Journal of Public Economics 89(4): 705 –27.

Gazette of India (2009), "Right of children to Free and Compulsory Education Act 2009." Ministry of Law and Justice (Legislative department). Part 2, section 1.

Gelli, A., N. Al-Shaiba, and F. Espejo. Forthcoming. "The Costs and Cost-Efficiency of Providing Food through Schools in Areas of High Food Insecurity." *Food and Nutrition Bulletin*.

Gelli, A., K. Izushi, Z. Islam, M. Matthew, and F. Espejo. (2006), "The Costs and Outcomes of Fortified Biscuit Interventions on Primary School-Age Children." World Food Programme, Rome.

Gelli, A., U. Meir, and F. Espejo. (2007), "Does Provision of Food in School Increase Girls' Enrollment? Evidence from Schools in Sub-Saharan Africa." *Food and Nutrition Bulletin* 28 (2): 149–55.

Gertler P. (2004), "Do Conditional Cash Transfers Improve Child Health? Evidence from PROGRESA's Control Randomized Experiment." American Economic Review Vol. 94 No. 2 May 2004 (pp. 336-341)

Glasziou P.P., Mackerras D.E. (1993), "Vitamin A supplementation in infectious diseases: a meta-analysis." BMJ 1993 Feb 6; 306(6874): 366-70.

Glassman A., Temin M. (2016), "Millions Saved: New Cases of Proven Success in Global Health." Centre for Global Development

Glewwe, P. (2002), "Schools and skills in developing countries: Education policies and socioeconomic outcomes." *Journal of Economic Literature* 40 (2): 436–482.

Glewwe, P. and E. Miguel (2008), "The Impact of Child Health and Nutrition on Education in Less Developed Countries," Handbook of Development Economics, Volume 4, 2008.

Glewwe, P., Park, A., Zhao, M. (2006). "The impact of eyeglasses on the academic performance of primary school students: Evidence from a randomized trial in rural China". University of Minnesota and University of Michigan.

Glewwe, P. & Park A & Zhao M (2012), "Visualizing Development:Eyeglasses and Academic Performance in Rural Primary Schools in China," Working Papers 120032, University of Minnesota, Center for International Food and Agricultural Policy.

Glewwe, P., Jacoby, H. (1995). "An economic analysis of delayed primary school enrollment in a low income country: The role of early childhood nutrition". Review of Economic Statistics 77 (1), 156–169.

Glewwe, P., Jacoby, H., King, E. (2001). "Early childhood nutrition and academic achievement: A longitudinal analysis". Journal of Public Economics 81 (3), 345–368.

Glewwe, P., and M. Kremer (2006), "Schools, teachers, and education outcomes in developing countries." In *Handbook of the economics of education,* volume 2, ed. E. A. Hanushek and F. Welch. Amsterdam and Oxford: Elsevier.

Glewwe, P., Kremer, M., Moulin, S., Zitzewitz, E. (2004). "Retrospective vs. prospective analyses of school inputs: The case of flip charts in Kenya". Journal of Development Economics 74 (1), 251–268.

Glewwe P., West K., Lee J. (2014), "The Impact of Providing Vision Screening and Free Eyeglasses on Academic Outcomes: Evidence from a Randomized Trial in Title 1 Elementary Schools." Working Paper.

Ghosh, P., Kochar, A. (2013), "Student absenteeism and School Health Programs in Bihar," IGC Working Paper.

Gogia S., Sachdev H.S. (2012), "Zinc supplementation for mental and motor development in children." Cochrane Database of Systematic Reviews. 2012 Dec 12; 12:CD007991

Gordon, R. C., M. C. Rose, S. A. Skeaff, A. R. Gray, K. M. Morgan, and T. Ruffman. 2009. "Iodine Supplementation Improves Cognition in Mildly Iodine-Deficient Children." American Journal of Clinical Nutrition 90 (5): 1264–71.

Government of India (1995), "National Programme of Nutritional support for Primary education Guidelines."

Government of India (2001), "National Programme of Nutritional support for Primary education" Report.

Government of India (2013), "Mid-day Meal Programme" Report

Government of Karnataka, Directorate of Health and Family Welfare services, Annual Report 2014-15

Government of Karnataka, (2016) "Suvarna Arogya Chaitanya Programme guidelines."

"Goyal, S., P. Pandey (2009), "How Do Government and Private Schools Differ? Findings from Two Large Indian States." South Asia human development sector series;no. 30. World Bank, Washington, DC.

Grantham-McGregor, S. M., and C. Ani. (2001), "A Review of Studies on the Effect of Iron Deficiency on Cognitive Development in Children." *Journal of Nutrition* 131 (2): 649S–6S.

Grantham-McGregor, S. M., S. Chang, and S. P. Walker. (1998), "Evaluation of school feeding programs: Some Jamaican examples." *American Journal of Clinical Nutrition* 67 (suppl): 785S–789S.

Grigorenko, E. L., R. J. Sternberg, M. Jukes, K. Alcock, J. Lambo, D. Ngorosho, C. Nokes, and D. A. Bundy. 2006. "Effects of Antiparasitic Treatment on Dynamically and Statically Tested Cognitive Skills over Time." *Journal of Applied Developmental Psychology* 27 (6): 499–526.

Grillenberger, M., C. Neumann, S. Murphy, N. Bwibo, P. van't Veer, J. G. A. J. Hautvast, and C. West. (2003), "Food supplements have a positive impact on weight gain and the addition of animal source foods increases lean body mass of Kenyan schoolchildren." *Journal of Nutrition* 133: 3957S–3964S.

Grosh, M., C. del Ninno, and E. D. Tesliuc. (2008), "Guidance for Responses from the Human Development Sector to Rising Food and Fuel Prices." World Bank, Washington, DC.

Grosh, M., C. del Ninno, E. Tesliuc, and A. Ouerghi. (2008), "For Protection & Promotion: The Design and Implementation of Effective Safety Nets." Washington, DC: World Bank.

Haas J & Brownlie T (2001), "Iron deficiency and reduced work capacity: A critical review of the Research to determine a causal relationship." J Nutr. 2001 Feb; 131(2S-2): 676S-688S; discussion 688S-690S.

Hamdani, S. (2008), "Micronutrient Sprinkles to Address Multiple Deficiencies in School Age Children." WFP School Feeding, Rome.

Hanushek, E. A. (1986) "The economics of schooling." *Journal of Economic Literature* 24: 1141–1177.

Hanushek, E. A., (2013) "Economic Growth in Developing Countries: The Role of Human Capital," Economics of Education review, Forthcoming

Harris, A.M., Schubert, J.G. (2001), "Defining "Quality" in the midst of HIV/AIDS: Ripple effects in the classroom." Washington, DC: American Institutes for Research.

Hoddinott, J., Maluccio J., Behrman J.R., Flores R., and Martorell R. (2008), "The impact of nutrition during early childhood on income, hours worked, and wages of Guatemalan adults." Lancet 371 (February), 411-416

Ibragimov and Muller U.K. (2016), "Inference with few Heterogeneous Clusters" The Review of Economics and Statistics, March 2016, 98(1): 83–96

International Food Policy Research Institute (IFPRI) (2016), "Global Nutrition Report".

International Institute for Population Sciences (IIPS) and Macro International (2007), National Family Health Survey (NFHS-3), 2005-06: India, Mumbai: IIPS.

International Institute for Population Sciences (IIPS) and Macro International (1999), National Family Health Survey (NFHS-2), 1998-99: India, Mumbai: IIPS.

Islam M., Hodinott J., (2009), "Evidence of Intrahousehold Flypaper Effects from a Nutrition Intervention in Rural Guatemala." *Economic Development and Cultural Change* Vol. 57, No. 2 (January 2009), pp. 215-238

Jacoby E, S. Cueto, E. Pollitt, (1996) “Benefits of a school breakfast program among Andean children in Huaraz, Peru,” Food Nutrition Bulletin, 1996, 17 (1), 54–64

Jacoby, H. G. (2002), “Is There an Intrahousehold ‘Flypaper Effect’? Evidence from a School Feeding Programme.” *The Economic Journal* 112 (476): 196–221.

Jaekel, J., V. Y Strauss, S. Johnson, C.Gilmore and D. Wolke, “Delayed school entry and academic performance: a natural experiment,” Developmental Medicine & Child Neurology, Volume 57, Issue 7, pages 652–659, July 2015

Jain, J. and Shah M. (2005), “MDM in 70 most backward villages of Madhya Pradesh,’’ Samaj Pragati Sahyog,Madhya Pradesh.

Jamison, D. T. (1986), “Child Malnutrition and School Performance in China.” Journal of Development Economics 20 (2): 299–309.

Jamison, D. T., W. H. Mosley, A. R. Measham, and J. L. Bobadilla, eds. (1993), “Disease control priorities in developing countries.” New York: Oxford University Press.

Jayaraman, R. and D. Simroth, (2011) “The impact of school lunches on primary school enrolment: Evidence from India’s Midday meal scheme,” European school of management and technology working paper

Jenkins S. (2005), “Survival Analysis.” Institute for Social and Economic Research, University of Essex

Jukes, M. (2006), “Early Childhood health, nutrition and education,” UNESCO report

Jukes, M. C. H., L. J. Drake, and D. A. P. Bundy (2008), “School Health, Nutrition and Education for All: Leveling the Playing Field.” Cambridge, MA: CABI Publishing.

Jukes, M. C., Pinder, M., Grigorenko, E. L., Smith, H. B., Walraven, G., Bariau, E. M.,Sternberg, R. J., Drake, L. J., Milligan, P., & Cheung, Y. B. (2006), “Long-term impact of malaria chemoprophylaxis on cognitive abilities and educational attainment: Follow-up of a controlled trial.” PLoS clinical trials, 1, e19.

Kazianga, H., D. de Walque, and H. Alderman (2012), “Educational and Health Impact of Two School Feeding Schemes: Evidence from a Randomized Trial in Rural Burkina Faso.” Working Paper, World Bank, Washington, DC.

Kristjansson, E., V. Robinson, M. Petticrew, B. MacDonald, J. Krasevec, L. Janzen, T. Greenhalgh, G. Wells, J. MacGowan, A. Farmer, B. J. Shea, A. Mayhew, and P. Tugwell. (2007), "School Feeding for Improving the Physical and Psychosocial Health of Disadvantaged Elementary School Children." *Cochrane Database of Systematic Reviews* 1.

Khera, R, (2006) "Mid-day meals in primary schools: Achievements and challenges," Economic and Political weekly, 2006, 4742-4750

Kingdon, G, (2007) "The progress of school education in India," Oxford Review of economic policy 23 (2), 2007, 163-195

Kingdon, G., (1996a), "The quality and efficiency of private and public education: a case study of urban India", Oxford Bulletin of Economics and Statistics, 58.1, 57-81

Kingdon, G., (1996b), "Private Schooling in India: Size, nature and equity effects", Economic and Political Weekly, 31, No. 51, December 1996.

Kingdon, G. and M. Muzammil (2001), "A Political Economy of Education in India- I: The Case of UP" Economic and Political Weekly, 36, No. 32, August 11-18, 2001

Kleiman-Weiner, M., Luo, R., Zhang, L., Shi, Y., Medina, A., & Rozelle, S. (2013), "Eggs versus chewable vitamins: Which intervention can increase nutrition and test scores in rural China?" China Economic Review, 24, 165-176.

Kremer, M., Brannen, C., & Glennerster, R. (2013), "The challenge of education and learning in the developing world." Science, 340, 297-300.

Kremer, M., Miguel, E., & Thornton, R. (2009), "Incentives to learn." The Review of Economics and Statistics, 91, 437-456.

Kremer, M., K. Muralidharan, N. Chaudhury, J. Hammer and F.H. Rogers (2004), "Teacher Absence in India", Washington: The World Bank.

Kremer, M., K. Muralidharan, N. Chaudhury, J. Hammer, and F. H. Rogers (2005), "Teacher Absence in India: A Snapshot" Journal of the European Economic Association, Volume 3, pp 658-667.

Kruger, M., C. J. Badenhorst, E. P. G. Mansvelt, J. A. Laubscher, and A. J. Spinnler Benade (1996) "Effects of iron fortification in a school feeding scheme and anthelmintic therapy on the iron status and growth of six- to eight-year-old schoolchildren." *Food and Nutrition Bulletin* 17 (1): 11–21.

Kumar, Vinod CS, Anand Kumar H., Sunita V., Indu Kapur, (2003) “Prevalence of Anemia and Worm Infestation in School Going Girls at Gulbarga, Karnataka” Indian Pediatrics, 2003;40:70-72

Kulkarni (2014), “Health status among children residing in urban field practice area of Belgaum – A cross sectional study,” International Journal of Pharma medicine and Biological sciences, Vol. 3, No. 1

Kvalsig, J.D., Cooppan, R.M., Connolly, K.J., (1991), “The effects of parasite infections on cognitive processes in children.” Ann. Trop. Med. Parasitol. 1991 Oct; 85(5): 551-68.

Latham, M. C., D. M. Ash, D. Makola, S. R. Tatala, G. D. Ndossi, and H. Mehansho. (2003), “Efficacy trials of a micronutrient dietary supplement in school- children and pregnant women in Tanzania.” *Food and Nutrition Bulletin* 24 (4): s120–s128.

Levine P.B., Schanzenbach D. (2009), “The Impact of Children’s Public Health Insurance Expansions on Educational Outcomes.” Forum for Health Economics & Policy. Volume 12, Issue 1 2009 Article 1 (Frontiers in Health policy research).

Levinger, B., (1986) “School Feeding Programs in Developing Countries: An Analysis of Actual and Potential Impact,” Aid Evaluation Special Study 30, U.S. Agency for International Development

Levinger B., (2005), “School feeding, school reform, and food security: connecting the dots.” Food and Nutrition Bulletin 2005 Jun;26(2 Suppl 2):S170-8.

Lindert, K., E. Skoufias, and J. Shapiro (2010), “Redistributing Income to the Poor and the Rich: Public Transfers in Latin America and the Caribbean.” World Development 38(6): 895–907.

Liu, R. Y. (1988): “Bootstrap Procedures under some Non-I.I.D. Models,” The Annals of Statistics, 16(4), 1696–1708.

Longfils, P., U. K. Heang, H. Soeng, and M. Sinuon (2005), “Weekly iron and folic acid supplementation as a tool to reduce anemia among primary school children in Cambodia.” *Nutrition Reviews* 63 (12): s139–s145.

Lozoff, B. (2007), “Iron Deficiency and Child Development.” Food and Nutrition Bulletin 28 (4 suppl.): S560–S71.

Lozoff, B., Beard, J., Connor, J., Felt, B., Georgieff, M., & Schallert, T. (2006), “Long-Lasting Neural and Behavioral Effects of Iron Deficiency in Infancy.” *Nutrition Reviews*, *64*(5 Pt 2), S34–S91.

Lundeen E.A., Behrman J.R., Crookston B.T., Dearden K.A., Engle P., Georgiadis A., Penny M.E., Stein A.D., (2014), "Growth faltering and recovery in children aged 1-8 years in four low- and middle-income countries: Young Lives," Public Health Nutrition 2014 Sep;17(9):2131-7.

Machado, J.A., Parente, P. and S.S., João, (2015), "QREG2: Stata module to perform quantile regression with robust and clustered standard errors."

Mammen E., (1993), "Bootstrap and Wild Bootstrap for High Dimensional Linear Models" *The Annals of Statistics*, Vol. 21, No. 1 (Mar., 1993), pp. 255-285

Mathur, B.. (2005), "Situation Analysis of MDM Programme in Rajasthan,'' University of Rajasthan and UNICEF.

McEwan P.J. (2012), "The impact of Chile's school feeding program on education outcomes." Economics of Education Review 32 (2013) 122–139

McEwan P.J. (2015), "Improving Learning in Primary Schools of Developing Countries: A Meta-Analysis of Randomized Experiments." Review of Educational Research September 2015, Vol. 85, No. 3, pp. 353–394

Mehta, A. (2005), "Elementary Education in unrecognized schools in India: A study of Punjab based on DISE 2005 data" NIEPA, New Delhi

Mendez, M. A., and L. S. Adair (1999), "Severity and Timing of Stunting in the First Two Years of Life Affect Performance on Cognitive Tests in Late Childhood." Journal of Nutrition 129 (8): 1555–62

Meundi A.D., Athavale A.V., Suruliraman S.M., Anjan S., Gururaj M.S., Dhabadi B.B., Rekha R., India, (2014) "Prevalence of Ocular Morbidities among School children in a rural area of South India," South American Journal of Medicine, Volume-2, Issue-2

Miguel, E. and M. Kremer (2004), "Worms: Identifying Impacts on Education and Health in the presence of Treatment Externalities," Econometrica, Vol. 72, No. 1 (January, 2004), 159–217

Ministry of Human Resource Development, Government of India (2012), "Selected Information on school education 2011-12."

Ministry of Human Resource Development, Government of India (2008-2012), "Statistics of school education."

Ministry of Human Resource Development, Government of India (2006-2008), "Table of Statistics of school education."

Ministry of Human Resource Development, Government of India (2014), "Annual Report 2013-14."

Ministry of Human Resource Development, Government of India. (2005), Department of School Education and Literacy, Chapter on Elementary Education.

Ministry of Human Resource Development, Government of India. (2008), Department of School Education and Literacy, Annual Report 2007-2008.

Ministry of Rural Development Report (2000), "Employment Assurance scheme."

Montresor A., Ramsan M., Chwaya H.M., Ameir H., Foum A., Albonico M., Gyorkos T.W., Savioli L. (2001), "School enrollment in Zanzibar linked to children's age and helminth infections." Trop Med Int Health. 2001 Mar; 6(3): 227-31.

Moock, P. R., and J. Leslie. (1986), "Childhood Malnutrition and Schooling in the Terai Region of Nepal." Journal of Development Economics 20 (1): 33–52

Moulton, B.R. (1986), "Random Group Effects and the Precision of Regression Estimates," Journal of Econometrics, 32, 385-397.

Moulton, B.R. (1990), "An Illustration of a Pitfall in Estimating the Effects of Aggregate Variables on Micro Units," Review of Economics and Statistics, 72, 334-38.

Murphy, S. P., C. Gewa, L. Liang, M. Grillenberger, N. O. Bwibo, and C. G. Neumann. (2003), "School snacks containing animal source foods improve dietary quality for children in rural Kenya." *Journal of Nutrition* 133: 3950S–3956S.

Naik, R. (2005), "Report on Akshara Dasoha scheme of Karnataka,'' University of Dharwad,Karnataka.

Narendranathan W. and M.B. Stewart (1991), "Modelling the probability of leaving unemployment: Competing risks models with flexible baseline hazards." Journal of the Royal Statistical Society, Series C (Applied Statistics) 42(1)

Narendranathan W. and M.B. Stewart (1993), "How does the benefit effect vary as unemployment spells lengthen?" Journal of Applied Econometrics, vol. 8, p.361-381

National Family Health Survey, International Institute for Population sciences, 1998

National Health Mission, Ministry of Health and Family services (2014), "Accredited Social Health Activist (ASHA)"

National Sample Survey Organisation, Department of Statistics, Government of India (1998), “Attending an Educational Institution in India: Its level, nature and costs.” Report No. 439(52/25.2/1)

National Sample Survey Organisation, Department of Statistics, Government of India (2011), “Participation in Education: NSS 52nd Round: July 1995- July 1996 Schedule 25.2”

National Sample Survey Organisation, Department of Statistics, Government of India (2012), “Participation and Expenditure in Education: NSS 64th Round: 2007- 2008 Schedule 25.2”

National Rural Health Mission (2012), “Rashtriya Bal Swasthya Karyakram Report”

NCERT (1982), “Fourth All India Education Survey”, National Council for Educational Research and Training, New Delhi.

NCERT (1992), “Fifth All India Education Survey”, National Council for Educational Research and Training, New Delhi.

NCERT (1998), “Sixth All India Education Survey”, National Council for Educational Research and Training, New Delhi.

NCERT (2006), “Seventh All India Education Survey”, National Council for Educational Research and Training, New Delhi.

Nokes, C., S. M. Grantham-McGregor, A. W. Sawyer, E. S. Cooper, B. A. Robinson, and D. A. P. Bundy (1992), “Moderate to Heavy Infections of Trichuris trichiura Affect Cognitive Function in Jamaican School Children.” Parasitology 104 (3): 539–47.

Nokes, C., van den Bosch, C., Bundy, D. (1998). “The effects of iron deficiency and anaemia on mental and motor performance, educational achievement, and behaviour in children: A report of the international nutritional anemia consultative group”. USAID, Washington, DC

Nokes, C., S. M. Grantham-McGregor, A. W. Sawyer, E. S. Cooper, B. A. Robinson, and D. A. Bundy (1992), “Moderate to Heavy Infections of *Trichuris trichiura* Affect Cognitive Function in Jamaican School Children.” *Parasitology* 104 (3): 539–47.

Nores, M., and W. S. Barnett (2009), “Benefits of Early Childhood Interventions across the World: (Under) Investing in the Very Young.” Economics of Education Review 29 (2): 271–82.

Planning Commission (2010), "Performance evaluation of Cooked Mid Day Meal." Social Development Intervention. Planning Evaluation Organisation, Planning commission, Government of India. PEO Report No.202

Pollitt, E. (1995), "Does breakfast make a difference in school?" *Journal of the American Dietetic Association* 95 (10): 1134–1139.

Pollitt, E., R. Leibel, and D. Greenfield. (1981), "Brief fasting, stress, and cognition in children." *American Journal of Clinical Nutrition* 34: 1526–1533.

Pollitt, E., N. L. Lewis, C. Garza, and R. Shulman. 1982/83. "Fasting and cognitive function." *Journal of Psychiatric Research* 17: 169–174.

Powell, C. A., S. P. Walker, S. M. Chang, and S. M. Grantham-McGregor (1998), "Nutrition and Education: A Randomized Trial of the Effects of Breakfast in Rural Primary School Children." *American Journal of Clinical Nutrition* 68: 873–9.

Pratham (2006), "Annual Status of Education Report."

Psacharopoulos, G and H.A. Patrinos, (2004) "Returns to Investment in Education: A Further Update," Education Economics, Vol. 12, No. 2

Public Report on Basic education in India, Oxford University Press, Delhi, 1990

Ravallion, M., and Q. Wodon. (1998), "Evaluating a Targeted Social Program when Placement is Decentralized." Policy Research Working Paper, Development Research Group, World Bank, Washington, DC.

Ravallion, M. and Q. Wodon, (2000), "Does Child labor displace schooling? Evidence on Behavioral Responses to an Enrollment Subsidy," Economic Journal, 2000, 158-175

Resnikoff, S., D. Pascolini, S. P. Mariotti, and G. P. Pokharel (2008), "Global Magnitude of Visual Impairment Caused by Uncorrected Refractive Errors in 2004." Bulletin of the World Health Organization 86 (1): 63–70

Robson, S., and K. B. Sylvester (2007), "Orphaned and Vulnerable Children in Zambia: The Impact of the HIV/AIDS Epidemic on Basic Education for Children at Risk." Educational Research 49 (3): 259–72.

Sandstead H.H., Penland J.G., Alcock N.W., Dayal H.H., Chen X.C., Li J.S., Zhao F., Yang J.J. (1998), "Effects of repletion with zinc and other micronutrients on neuropsychologic performance and growth of Chinese children." American Journal of Clinical Nutrition 1998;68:470S–475S

Schady, N. (2008), "The Impact of an Economic Contraction on Human Capital: Evidence from LAC and the World." Presentation at the World Bank, Washington, DC, May.

Schott, W. B., Crookston, B. T., Lundeen, E. A., Stein, A. D., Behrman, J. R., & the Young Lives Determinants and Consequences of Child Growth Project Team. (2013), "Periods of Child Growth up to age 8 Years in Ethiopia, India, Peru and Vietnam: Key Distal Household and Community Factors," Social Science and Medicine, *97*, 10.1016.

Schultz, T.P. (2004), "School subsidies for the poor: evaluating a Mexican strategy for reducing poverty." Journal of Development Economics 74:2 (June), 199-250.

Sen, A. (2005), "Cooked mid day meal programme in West Bengal-A study in Birbhum district,'' Pratichi Trust,West Bengal.

Seshadri, S., Gopaldas, T. (1989). "Impact of iron supplementation on cognitive functions in preschool and school-aged children: the Indian experience". American Journal of Clinical Nutrition 50 (3), 675–686.

Shiff C., Winch P., Minjas J, Premji Z. (1996), "The Implementation and sustainability of insecticide-treated Mosquito Net (IMN) Programs for Malaria control in rural Africa:: Lessons Learned from the Bagamoyo Bednet Project, Tanzania." Summary Report.

Siekmann, J. H., L. H. Allen, N. O. Bwibo, M. W. Demment, S. P. Murphy, and C. G. Neumann (2003), "Kenyan school children have multiple micronutrient deficiencies, but increased plasma vitamin B-12 is the only detectable micro-nutrient response to meat or milk supplementation." *Journal of Nutrition* 133: 3972S–3980S.

Simoes E.A.F., Cherian T., Chow J., Sonbol A. Shahid-Salles, Laxminarayan R., and T. Jacob John (2006), "Acute Respiratory Infections in Children." In: Jamison DT, Breman JG, Measham AR, et al., editors. "Disease Control Priorities in Developing Countries." 2nd edition. Washington (DC): The International Bank for Reconstruction and Development / The World Bank; 2006. Chapter 25

Simeon, D. T. (1998), "School Feeding in Jamaica: A Review of its Evaluation." *American Journal of Clinical Nutrition* 67 (4): 790s–4s.

Simeon, D. T., and S. Grantham McGregor. (1989), "Effects of Missing Breakfast on the Cognitive Functions of School Children of Differing Nutritional Status." *American Journal of Clinical Nutrition* 49 (4): 646–53.

Simeon, D. T., S. M. Grantham-McGregor, and M. S. Wong. (1995), "*Trichuris trichiura* Infection and Cognition in Children: Results of a Randomized Clinical Trial." *Parasitology* 110 (4): 457–64.

Singh, A., Park, A., Dercon, S. (2014), "School Meals as a Safety Net: An Evaluation of the Midday Meal Scheme in India." Economic Development and Cultural Change. Vol. 62, No. 2 (January 2014), pp. 275-306

Sixth All India Education survey, National Council of Educational Research and training, 1999

Soemantri, A.G., Pollitt, E., Kim, I. (1989), "Iron deficiency anemia and education achievement". American Journal of Clinical Nutrition 50 (3), 698–702.

Soewondo, S., M. Husaini, and E. Pollitt (1989), "Effects of Iron Deficiency on Attention and Learning Processes in Preschool Children: Bandung, Indonesia." American Journal of Clinical Nutrition 50 (3): 667–74

Solon, F. S., J. N. Sarol, A. B. I. Bernardo, J. A. A. Solon, H. Menhansho, L. E. Sanchez-Fermin, L. S. Wambangco, and K. D. Juhlin (2003), "Effect of a multiple- micronutrient-fortified fruit powder beverage on the nutrition status, physical fitness, and cognitive performance of schoolchildren in the Philippines." *Food and Nutrition Bulletin* 24 (4 suppl.): S129–S140.

Sommer A, Tarwotjo I, Djunaedi E, West KP Jr, Loeden AA, Tilden R, Mele L (1986), "Impact of vitamin A supplementation on childhood mortality. A randomised controlled community trial." Lancet 1986 May 24; 1(8491): 1169-73.

Strauss, J., and D. Thomas (1995), "Human resources." In *Handbook of development economics:* volume 3, ed. J. Behrman and T. N. Srinivasan. Amsterdam: North- Holland.

Studdert, L. J., Soekirman, K. M. Rasmussen, and J.-P. Habicht. (2004), "Community-Based School Feeding during Indonesia's Economic Crisis: Implementation, Benefits, and Sustainability." *Food and Nutrition Bulletin* 25 (2): 156–65.

Sumadhya D.F., Chaturaka R. and S. Rajapakse, (2010) "The 'hidden' burden of malaria: cognitive impairment following infection." Malaria Journal, 2010, Volume 9, Number 1

Tan, J.-P., J. Lane, and G. Lassibille. (1999), "Student Outcomes in Philippine Elementary Schools: An Evaluation of Four Experiments." *World Bank Economic Review* 13 (3): 493–502.

Thein-Hlaing, Thane-Toe, Than-Saw, Myat-Lay-Kyin, and Myint-Lwin's (1991), "A controlled chemotherapeutic intervention trial on the relationship between Ascaris lumbricoides infection and malnutrition in children." Transactions of the Royal Society of Tropical Medicine and Hygiene, 1991 Jul-Aug;85(4):523-8.

Todd, P.E., and Wolpin K. (2006), "Using a social experiment to validate a dynamic behavioral model of child schooling and fertility: assessing the impact of a school subsidy program in Mexico." American Economic Review 96:5, 1384-1417.

UNAIDS (2008). Report on the Global AIDS Epidemic 2008. Geneva: UNAIDS.

UNESCO (2000), "World Education report."

UNESCO Institute of Statistics (2005), "Children out of school – Measuring exclusion from Primary education."

UNESCO (2014), "Global Initiative on Out-of-school Children." South Asia regional study covering Bangladesh, India and Sri Lanka.

United Nations (2000). IACC/SCN 4th Report on the World Nutrition Situation. Washington, DC (in collaboration with the International Food Policy Research Institute.)

United Nations (2010), "The Millennium Development Goals Report 2010"

UN Development Programme (UNDP) (2010), "What Will It Take to Achieve the Millennium Development Goals? – An International Assessment"

UNESCO Institute for Statistics (2008), "Education for All by 2015. Will we make it?" Education for All Global Monitoring report. Oxford University press.

UNICEF (2005), "World Malaria Report – Fact sheet"

UNICEF (2014), "Better Health Better Education," Bangladesh Country Office, Education, March 2014.

Van Stuijvenberg, M. E., J. D. Kvalsvig, M. Faber, M. Kruger, D. G. Kenoyer, and A. J. S. Benade (1999), "Effect of Iron-, Iodine-, and Beta-Carotene-Fortified Biscuits on the Micronutrient Status of Primary School Children: A Randomized Controlled Trial." *American Journal of Clinical Nutrition* 69 (3): 497–503.

Vazir S, Nagalla B, Thangiah V, Kamasamudram V, Bhattiprolu S. (2006), "Effect of micronutrient supplement on health and nutritional status of schoolchildren: mental function." Nutrition. 2006 Jan;22(1 Suppl):S26-32.

Vermeersch, C. and M. Kremer, (2004) "School meals, educational achievement and School completion: Evidence from a randomized evaluation," Policy Research Working Paper No. 2523, World Bank, Washington, DC.

Walter, T., E. Hertrampf, F. Pizzaro, M. Olivares, S. Llaguno, A. Letelier, V. Vega, and A. Stekel (1993), "Effect of bovine-hemoglobin–fortified cookies on iron status of schoolchildren: A nationwide program in Chile." *American Journal of Clinical Nutrition* 57: 190–194.

Watanabe, K., R. Flores, J. Fujiwara, and T. H. T. Lien (2005), "Early Childhood Development Interventions and Cognitive Development of Young Children in Rural Vietnam." Journal of Nutrition 135 (8): 1918–25.

Watkins, W. E., and E. Pollitt (1997), "'Stupidity or Worms': Do Intestinal Worms Impair Mental Performance?" *Psychological Bulletin* 121: 171–91.

Whaley, S. E., M. Sigman, C. Neumann, N. Bwibo, D. Guthrie, R. E. Weiss, S. Alber, and S. P. Murphy (2003), "The impact of dietary intervention on the cognitive development of Kenyan school children." *American Society for Nutritional Sciences* 133: 3965S–3971S.

Whaley, S. E., M. Sigman, C. Neumann, N. Bwibo, D. Guthrie, R. E. Weiss, S. Alber, and S. P. Murphy (2003), "The Impact of Dietary Intervention on the Cognitive Development of Kenyan School Children." *Journal of Nutrition* 133 (11): 3965S–71S.

Wooldridge J. M. (2010) "Econometric Analysis of Cross Section and Panel Data" MIT Press, Second edition

World Bank, (2000), "The FRESH Framework: A Toolkit for Task Managers." Human Development Network, World Bank, Washington, DC

World Bank (2006), "Repositioning nutrition as central to development." Washington, D.C.

World Bank (2014), "School Health" Uganda Country Report

World Bank Water and Sanitation Program, (2010), "Peru: A Handwashing Behavior Change Journey."

World Food Programme (WFP) Report (2015), Annual Report 2015.

World Food Programme, (2004), "*Global school feeding report, 2004.*" Rome.

World Food Programmme, (2009) “Feed Minds, Change lives School feeding: Highlights and new directions.”

WFP’s School Feeding Policy: a Policy Evaluation Volume I, November 2011

World Food Programme, (2003). “Exit Strategies for School Feeding: WFP’s Experience.” WFP/EB.1/2003/4/C, WFP, Rome.

World Food Programmme (2007a), “Checklist for the Use of Milk in School Feeding Programmes.” Unpublished, School Feeding Service, Nutrition Service, WFP, Rome.

World Food Programmme (2007b), “Standard Project Report: Cambodia Protracted Relief and Recovery Operation.” SPR10305.1, World Food Programme, Rome.

World Food Programmme (2007c), “Status of School Feeding in WFP Phase-Out Countries.” WFP, Rome.

World Food Programmme (2007d), “Summary Report of the Thematic Evaluation of School Feeding in Emergency Situations.” WFP/EB.A/2007/7-A, WFP, Rome.

World Food Programmme (2009) “Home-Grown School Feeding: A Framework for Action.” WFP, Rome.

World Food Programmme and UNICEF (2005), “The Essential Package: Twelve Interventions to Improve the Health and Nutrition of School-Age Children.” WFP, Rome.

World Food Programmme Pakistan (2005), “Situation Analysis: WFP’s Assistance to Girl’s Primary Education in Selected Districts of NWFP.” WFP Pakistan, Islamabad.

WFP’s School Feeding Policy: a Policy Evaluation Volume I, November 2011

World Food Programmme (2013) “Annual Evaluation Report.”

World Food Programmme (2013) “State of School Feeding Worldwide.”

World Food Programme (2015), “FEED MINDS, CHANGE LIVES: School feeding, the Millennium Development Goals and Girls' Empowerment.”

World Health Organization (WHO) (2000). "The world health report 2000". Geneva.

World Health Organization (WHO) (2003), "Africa Malaria Report"

World Health Organization (WHO) (2012), "Global Health Observatory"

World Health Organization (WHO), 2013, "Conducting a school deworming day: a manual for teachers."

World Health Organization (WHO), 2014, "The work of WHO Rwanda in 2014-15 Biennium." Supporting Health services delivery for Universal Health coverage in Rwanda.

World Health Organization (WHO), 2007, "Malaria prevention and control: an important responsibility of a health-promoting school." WHO information series on school health, document 13.

Wu, C. F. J. (1986): "Jacknife, Bootstrap, and other Resampling Methods in Regression Analysis," Annals of Statistics, 14(4), 1261–1295.

Zimmermann, M. B., K. Connolly, M. Bozo, J. Bridson, F. Rohner, and L. Grimci. (2006), "Iodine Supplementation Improves Cognition in Iodine-Deficient Schoolchildren in Albania: A Randomized, Controlled, Double-Blind Study." American Journal of Clinical Nutrition 83 (1): 108–14.

Zimmermann, M. B., D. Moretti, N. Chaouki, and T. Torresani. (2003), "Development of a Dried Whole-Blood Spot Thyroglobulin Assay and Its Evaluation as an Indicator of Thyroid Status in Goitrous Children Receiving Iodized Salt." American Journal of Clinical Nutrition 77 (6): 1453–58.